

Soil/Sediment Design Comparison (15%) Study

**Standard Chlorine of Delaware Site
New Castle County, Delaware**

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1.0 Introduction

The United States Environmental Protection Agency (EPA), under the authority of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), has initiated procedures to conduct a Remedial Design (RD) at the Standard Chlorine of Delaware (SCD) Site, New Castle County, DE. This Design Comparison Study has been prepared by the Tetra Tech/Black & Veatch Joint Venture (JV) under Contract Number 68-S7-3002 with EPA Region III and under specific authorization of EPA Region III through Work Assignment Number 038-RDRD-03H6. Black & Veatch Special Projects Corp. (BVSPC) is the lead member of the JV for this work assignment.

1.1 Purpose and Scope

In accordance with the Remedial Design Work Plan, BVSPC presents this Design Comparison (15%) Study (Study) for the SCD Site in New Castle County, DE. This Report represents an approximately 15 percent level of completion. Included are descriptions and objectives of the two proposed soil/sediment remedy alternatives, together with a comparison of the projected costs, environmental and public impacts, implementation requirements, and potential barriers to implementation for each remedial approach. This study is intended to be used as a basis for determining whether on site or off site thermal treatment of excavated materials provides the most feasible and cost-effective remedial approach for the contaminated soil and sediments at the SCD Site. Not included as part of this submission are design details for the proposed excavation and treatment that represent efforts beyond the 15 percent level of completion. The Preliminary and Pre-Final design submissions will build upon this document, providing greater detail and information required for successful implementation of the remedial action.

1.2 Report Organization

This Report is organized into the following sections:

- Section 1 contains the Introduction to this document.
- Section 2 contains a description of the Site Conditions, including physical setting, site history, geology, hydrogeology, and soil/sediment characterization.

- Section 3 presents the Project Criteria for the two design alternatives.
- Section 4 presents an Alternatives Analysis and description of the two alternatives.
- Section 5 contains the Preliminary Cost Estimate for the project.
- Section 6 provides the estimated Remedial Action Schedule.
- Section 7 presents the Conclusions of the Design Comparison Study.
- Section 8 present References used in the development of this study.

2.0 Site Conditions

2.1 Site Location and Description

The SCD Site is located on Governor Lea Road, in an industrialized area located approximately three miles northeast of Delaware City in New Castle County, Delaware. Residential and commercial properties are located within one mile of the facility (to the west). The SCD Site is bordered to the east by Occidental Chemical Company (formerly Diamond Shamrock Company) property, to the west by Air Products, Inc. and to the south by Governor Lea Road. Governor Lea Road separates the SCD Site from property owned by Motiva Enterprises, LLC (formerly Star Enterprises) and Connectiv (formerly Delmarva Power and Light). The fence line of the former SCD/Metachem manufacturing facility (facility) encompasses approximately 26 acres. The SCD Site as a whole encompasses approximately 65 acres with its southernmost boundary adjacent to Governor Lea Road and its northern extent reaching to the southern edge of Red Lion Creek. The site location is presented in Figure 1.

2.1.1 Site Topography and Surface Drainage

The SCD facility is located on relatively flat land approximately 50 feet above mean sea level (MSL). The terrain within the facility's fence line is relatively flat with the exception of various manmade containment and drainage features. Containment structures surround various storage tank and process areas located within the facility's fence line. The Site's wastewater treatment system includes an open catch basin (located near the center of the facility), and shallow drainage ditches run through the eastern portion of the facility (approximately two to four ft deep) and along the facility's rail siding (approximately one foot deep). The land between the SCD facility's northern fence line and the Red Lion Creek is wooded (trees typically less than 6 inches diameter). This area remains undeveloped with the exception of gravel roads (single lane), a sedimentation lagoon/basin, two soil piles, and other features constructed as part of past remedial and monitoring activities. With the exception of the area occupied by Air Products, elevations decrease rapidly to the west of the SCD facility, leveling out a few feet above MSL in the wetlands surrounding an unnamed tributary of the Red Lion Creek. The area to the north of the facility is relatively flat, but it drops off sharply (to approximately MSL) as it nears the Red Lion Creek.

The vast majority of the wetlands areas are covered with thick stands of phragmites australis. There are visible signs of active beaver and deer populations in the wooded and wetland areas,

and ponded areas exist in two locations in the tributary wetlands (a result of two separate beaver dams).

Surface water runoff from the facility drains primarily to the east and west. Run-off from the eastern portion of the facility is directed through a drainage ditch – referred to as the eastern drainage ditch in the Record of Decision (ROD) – and eventually passes through a weir before emptying into the Red Lion Creek. Run-off from the western side of the facility travels off-site and down to an unnamed tributary of the Red Lion Creek via two main drainage features. The first is a drainage ditch that runs along Governor Lea Road in front of the Air Products facility. The second is an eroded gully – referred to as the western drainage gully in the Record of Decision (ROD) – located at the northwestern corner of the facility (Weston, 1992).

2.1.2 Site Geology

Geologic investigations conducted as part of the Remedial Investigation (RI) of the SCD Site found that the Site is located above the Potomac, Merchantville, and Columbia Formations in the Atlantic Coastal Plain Physiographic Province. The Columbia Formation – consisting largely of fine sand and medium sand and gravel – is the uppermost geologic unit found at the Site and ranges in thickness from approximately 10 to 20 feet in the tributary wetlands to as much as 74 feet in some of the upland Site areas. The Merchantville Formation (ranging in thickness from 0 to 21 feet) underlies the Columbia Formation but was absent from the central portion of the Site. This formation is predominantly composed of material ranging from gray micaceous clay to silty/sandy clay. The upper portion of the Potomac Formation – which underlies the Columbia and Merchantville Formations – consists largely of interbedded clay, silt, and sand and overlies a water-bearing sand unit referred to in the RI Report as the upper Potomac aquifer.

The soils underlying the SCD Site consist primarily of Matapeake silt loam interspersed with small areas of Sassafra sandy loam. In general, these are deep well-drained soils, which are susceptible to erosion on sloping areas (Weston, 1992). Additional information on Site geology can be found in the RI Report for the Site.

2.1.3 Site Hydrogeology

The Columbia Formation provides the uppermost groundwater system in the SCD Site area. The RI Report states that groundwater elevations in this area largely mirror topographic elevations with groundwater flowing generally to the north towards the Red Lion Creek and the unnamed tributary located to the west/northwest of the SCD Site.

Based on available geologic data and aquifer testing results, the RI Report suggests that the upper portion of the Potomac Formation, together with the Merchantville Formation (where it exists), form a confining layer beneath the Site (Weston, 1992). During previous and RD Site investigations, it was determined that the thickness of this confining unit varies greatly across the Site, and the top surface of the unit is located between approximately 60 feet and approximately 70 feet below ground surface in the upland areas of the Site. Underlying this confining layer is the water-bearing sand unit referred to above and in the RI Report as the upper Potomac aquifer. Using data from the RI and other potentially responsible party (PRP) led investigations, it was determined that groundwater flow in this second aquifer occurs in a southeasterly direction (CRA, 2000, 2001).

As part of the RI, a comparison of hydraulic heads occurring in the Columbia and Potomac Formations was performed for the SCD Site area. The results suggest that an upward vertical hydraulic gradient exists in those areas immediately surrounding the Red Lion Creek and its unnamed tributary. Conversely, the comparison indicated the presence of a downward vertical hydraulic gradient in the upland areas of the Site.

According to the RI Report, the Columbia Formation does serve as a water supply source on a regional basis, but there are no potable water supply wells drawing from it in the immediate area of the SCD Site. It has since been determined that as recently as 2002, at least one potable water supply well (located to the north of Red Lion Creek) within a one mile radius of the facility was drawing from the Columbia Formation. The RI Report does note that groundwater is drawn from the upper Potomac aquifer (for potable supply purposes) in the SCD Site vicinity (Weston, 1992).

A more complete discussion of Site Hydrogeology can be found in the RI Report.

2.2 Site History

The SCD facility was built in 1965 on approximately 46 acres of farmland that was previously owned by the Diamond Alkali Company. The Diamond Alkali Company had previously purchased the land from the Tidewater Refinery Company. Chlorinated benzene compounds were been manufactured on site from 1966 until the facility's closure in May 2002. Chlorine (piped in from the Occidental Chemical facility) and benzene (obtained primarily from the Motiva facility located on the south side of Governor Lea Road) were the main raw materials for chlorinated benzene production processes. The facility underwent an expansion in the early 1970s to begin production of chlorinated nitrobenzene and to increase production of chlorobenzene, dichlorobenzene, and trichlorobenzene. Production of

chlorinated nitrobenzene ended in the late 1970s, and the related capacity was switched to the production of chlorobenzene. The facility was also expanded in the late 1970s. Following that expansion, the SCD facility produced chlorobenzene, paradichlorobenzene, various isomers of trichlorobenzene, and chlorobenzene-based insulating fluids (Weston, 1993).

In December of 1998, SCD was sold as a whole to Metachem Products, LLC (Metachem). According to Metachem's former Environmental Manager, Metachem also purchased all of the land located between the facility boundaries and the Red Lion Creek that was known to have been impacted by SCD's releases. SCD (and its successor company, Metachem) have been identified as PRPs.

2.2.1 1981 Release and Response

In September of 1981, approximately 5,000 gallons of chlorobenzene were released during the transfer of chemicals to a railroad tank car. This release occurred near the western boundary of the SCD Site. Spilled chemicals traveled along the western boundary of the SCD Site and into the drainage ditch that runs westward along Governor Lea Road towards an unnamed tributary of the Red Lion Creek. As part of their response action, SCD recovered a portion of the surface runoff and removed surface soils in the release area and the drainage ditch located along Governor Lea Road. The excavated soil was then shipped to a permitted off-site disposal facility. This removal action was performed under the supervision of the Delaware Department of Natural Resources and Environmental Control (DNREC). SCD also conducted a limited subsurface investigation in the area of the release to determine the potential for migration of the spilled chlorobenzene into the underlying groundwater. Based on the results of this investigation, SCD and DNREC concluded that the potential existed for groundwater contamination to occur (Weston, 1992).

Following these actions, SCD, through its contractor, conducted additional investigation and assessment activities that included the installation of groundwater monitoring wells at various locations on the SCD property. The sampling and analysis conducted as part of these investigations revealed that the groundwater was contaminated with multiple types of chlorinated benzenes. It was subsequently determined that the primary source for the chlorinated benzenes in the groundwater is a leak that SCD detected in the wastewater treatment plant's (WWTP's) catch basin in March 1976. According to the 1992 Feasibility Study (FS) performed by SCD's contractor, this catch basin was repaired by SCD in 1976, but the surrounding soils – in which contamination has been detected – were left in place (Weston, 1993).

To address the groundwater contamination, SCD installed a series of recovery wells and modified their existing WWTP to include an air stripper. An additional clarifier and tertiary sand filter were added to address the increased flow. A modified NPDES permit for the facility was issued by DNREC on January 21, 1985 and the system was brought on-line in 1986.

2.2.2 1986 Release and Response

A subsequent incident, occurring in January 1986, involved the failure of a 375,000-gallon tank located near the western boundary of the SCD Site. The spill resulting from the collapse of this first tank damaged three nearby tanks causing additional releases of volatile organic compounds (VOCs). Approximately 569,000 gallons of various VOCs – including chlorobenzene, paradichlorobenzene and trichlorobenzene compounds – were released during this incident.

A portion of the spilled chemicals from this release solidified on contact with the paved areas of the SCD facility. Much of this material was subsequently recovered for reprocessing by SCD.

Some of the spilled chemicals from the 1986 release traveled northward to the northwest corner of the SCD property. From this point, they flowed down the western drainage gully and into a wetlands area surrounding an unnamed tributary of the Red Lion Creek. Chemicals from the 1986 release also flowed eastward across paved sections of the SCD property into the eastern drainage ditch. This material then traveled northward until it reached the facility's northern fence line.

As part of the initial response to this spill, SCD constructed a berm and a silt fence across the tributary wetlands area. These were constructed to minimize the transport of contaminants into the Red Lion Creek. Contaminated sediments were excavated from the wetlands area to the north of the silt fence and placed in a lined sedimentation basin that was constructed to the north of the SCD facility fence line. Other contaminated materials were placed in soil piles that were constructed to the northwest of the facility fence line (Weston, 1992).

During the RI, water samples collected from between the two layers of the sedimentation basin's liner showed the presence of site contaminants. This, together with the age of the liner system, suggests that the contamination might have migrated from the basin into the underlying soil. During the field activities conducted as part of this RD, it was also determined that the silt fence that was installed in the tributary wetlands area has deteriorated to the point that it is no longer functional.

2.3 Site Status

Because of the releases described above, the SCD Site was added to the National Priorities List (NPL) in 1987. A Consent Order (between DNREC and SCD) covering the performance of a Remedial Investigation and Feasibility Study (RI/FS) at the Site was signed on January 12, 1988 and amended on November 14, 1988. The ROD (ROD, 1995) for the Site was completed on March 9, 1995, and an Administrative Order for Remedial Design and Remedial Action was signed on May 30, 1996.

Primary contaminants of concern (COCs) identified in the ROD include:

- Benzene
- Chlorobenzene
- 1,2-Dichlorobenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- Hexachlorobenzene
- Nitrobenzene
- Pentachlorobenzene
- 1,2,3,4-Tetrachlorobenzene
- 1,2,4,5-Tetrachlorobenzene
- Toluene
- 1,2,3-Trichlorobenzene
- 1,2,4-Trichlorobenzene
- 1,3,5-Trichlorobenzene

The Baseline Risk Assessment (BLRA) and subsequent RD activities have also identified polychlorinated biphenyls (PCBs), metachloronitrobenzene, and dioxins as Site-related contaminants, but they were not included as COCs in the ROD. The ROD established a cleanup level of 33 mg/kg total COCs for soils and sediments located outside of the facility fence line. For on-site soils and sediments (those located within the facility fence line), the ROD specified cleanup levels of 450 mg/kg 1,4-dichlorobenzene and 625 mg/kg total COCs (ROD, 1995).

On April 30, 2002, following the bankruptcy of one of their major customers, Metachem announced that they would be closing the SCD facility. At that time, Metachem did not specify a closing date, and they left open the possibility of having the plant operate at a reduced capacity. Metachem closed the facility on May 4, 2002 and declared bankruptcy six days later (May 10, 2002). Shortly after this, Metachem abandoned the SCD Site (on May 14, 2002) to the EPA and DNREC. Since then, the USEPA and DNREC have been cooperating to implement an emergency cleanup action and determine an approach for the long-term rehabilitation of the SCD Site.

While the SCD facility is no longer an active manufacturing plant, chemical removal/site decontamination activities, involving EPA and DNREC, are currently in progress. As part of these activities, a portion of the SCD facility's equipment, including the wastewater

treatment plant and various process equipment are currently being operated by the EPA, DNREC, and their respective contractors. Additionally, the rail siding located on the western side of the facility is being utilized during chemical removal efforts.

The ROD's on-site cleanup levels in particular reflect the fact that the facility was operational at the time they were established. Given the recent change in facility status, it is possible that these numbers will be revised.

2.4 Soil and Sediment Characterization

In addition to Site sampling activities conducted during the emergency responses to the 1981 and 1986 spills, three major phases of soil and sediment sampling were conducted. RI field activities were conducted by a PRP contractor between November 1989 and September 1992 and included substantial sampling of surface soils, subsurface soils, and sediments located on and around SCD property. A second PRP contractor conducted a limited round of soil sampling (covering "hot spots" within the facility fence line and select subsurface locations) as part of an initial RD effort in September 1999 (CRA, 2000). Most recently, BVSPC has conducted additional sampling of soils and wetlands sediments to determine the accuracy and usability of data from the previous sampling events as well as to further delineate the extent to which Site-related contaminants have impacted the area.

2.4.1 RI Field Investigation

Extensive sampling of the soils and sediments located in and around the Site was conducted during the RI. The RI sampling (conducted in 1991) concentrated on the paths of the 1981 and 1986 spills, soil piles and the sedimentation basin containing excavated materials from these spills, the Red Lion Creek (and surrounding wetlands), the unnamed Red Lion Creek tributary (and surrounding wetlands), and the area surrounding the facility's wastewater catch basin.

Sampling activities related to chemical soil and sediment characterization are described below. Complete details of the RI sampling effort are presented in the 1992 RI Report (Weston, 1992).

2.4.1.1 1981 Release Pathway Sampling

A total of 35 soil samples was collected from 16 locations along the path traveled by the chlorobenzene that was spilled in 1981. At each location, one sample was collected from a depth of 0 to 6 inches below ground surface (bgs) and one from a depth of 12 to 18 inches bgs. Total site contaminant concentrations of 8,901 mg/kg (0 to 6 inch interval) and 311

mg/kg (12 to 18 inch interval) were detected at one location along the facility's rail siding (SS-15). The remainder of the shallow/surface soil sample results revealed COC concentrations ranging from 0.04 mg/kg to 34.1 mg/kg.

Based on the results from the samples collected at location SS-15, three subsurface samples were collected (from depths of 5-7 feet, 15-17 feet and 25-27 feet bgs) at that location. Analysis of subsurface samples showed COC concentrations ranging from 3,049 mg/kg to 8,324 mg/kg.

Testing conducted on two samples (one shallow/surface soil and one subsurface soil sample) from this area failed to detect the presence of PCBs.

2.4.1.2 1986 Release Pathway Sampling

80 soil samples were collected from 29 locations along the path taken by the chemicals spilled in the 1986 release. The sample locations covered the northern flow path (which included the rail siding and the western drainage gully) and the eastern flow path (which included the eastern drainage ditch) of the spill. Shallow/surface soil samples were collected from 0 to 6 inches bgs and 12 to 18 inches bgs at all but one location. A total of 25 subsurface soil samples were collected from soil borings installed at two locations in the rail siding area, two locations in the western drainage gully, and three locations in the eastern drainage ditch. Analysis of these samples showed that contamination was widespread along both pathways with the highest levels of contamination generally detected in samples collected from the shallower depth intervals.

Northern Flow Path: In shallow/surface soil samples collected along the rail siding, a median COC concentration of 2,883 mg/kg was observed with concentrations exceeding the on-site cleanup levels in 10 of the 16 samples. COC concentrations in subsurface samples from this area were generally lower (ranging from 0.43 mg/kg to 837 mg/kg) with only one sample exceeding the on-site cleanup levels. No PCB data was available for samples from this area.

Significant contamination was also found in samples collected from the western drainage gully. Concentrations in the shallow/surface soil samples collected from the gully ranged from 3.5 mg/kg to 103,525 mg/kg with a median concentration of 4,402 mg/kg. 13 of the 15 shallow/surface samples collected in this area had concentrations of COCs that exceeded the off-site cleanup levels (this area is outside the facility fence line). COC concentrations found in the subsurface samples from this area were lower than those in the shallow/surface samples (median concentration of 1,302 mg/kg), but contaminant levels still exceeded the off-site criteria in all four subsurface samples. No PCB data was available for samples from

this area.

Eastern Flow Path: With COC concentrations ranging from 1.3 mg/kg to 42,179 mg/kg (median of 2,250 mg/kg), shallow/surface samples collected from the eastern drainage ditch generally had the highest COC concentrations of the samples collected from the eastern flow path. Nine of the 14 samples collected from this area had COC concentrations exceeding the on-site cleanup criteria. In comparison, none of the 10 samples collected along the eastern fence line showed COC concentrations greater than either the on-site or off-site criteria. Similarly, only four of the 15 subsurface samples collected from the drainage ditch area had contaminant concentrations greater than 100 mg/kg and only one had concentrations in excess of the on-site criteria. No PCB data was available for samples from these areas.

2.4.1.3 Soil Piles and Sedimentation Basin

Significant concentrations (ranging from 24,210 mg/kg to 105,246 mg/kg) of Site-related contaminants were detected in all three samples collected from the soil piles located to the northwest of the facility fence line. Analysis of samples collected from potential runoff areas surrounding the soil piles showed only low concentrations of Site contaminants with no sample exceeding the off-site cleanup level. PCBs were detected at 6 mg/kg in the one soil pile sample on which that analysis was conducted, but no PCBs were detected in a sample collected from a runoff area.

Elevated COC concentrations (total concentration of 43,931 mg/kg) were also detected in the one sediment sample that was collected from the sedimentation basin located to the north of the facility fence line. No PCBs were detected in the sample.

2.4.1.4 Red Lion Creek Sediments

Approximately 49 sediment samples were collected from the Red Lion Creek and adjacent wetlands at various locations ranging from Route 9 in the east to west of Route 7. Site contaminants were detected in all samples collected east of Route 13 and in two samples collected to the west of Route 7. Only five of the samples had COC concentrations in excess of the ROD's off-site cleanup level. These included two samples collected at the confluence of the Red Lion Creek and its unnamed tributary (located to the northwest of the facility), one sample approximately 1,600 feet upstream (west) of the tributary, and two samples collected between 300 and 800 feet downstream (east) of the tributary.

2.4.1.5 Unnamed Tributary Sediments

Sediment sampling in the unnamed tributary and surrounding wetlands included 10 sediment

samples collected from the bed of the tributary and 51 sediment samples collected from the surrounding wetland areas. Bed sediments and wetlands sediments showed similar patterns of contaminant distribution, with the highest contaminant concentrations generally detected between the berm and the mouth of the tributary (denoted by the line of the former silt fence). Other portions of the tributary where COC concentrations exceeded the off-site cleanup criteria included the area surrounding the base of the western drainage gully in the south, the area extending from the berm approximately 250 feet south, and a small area located approximately 550 feet south of the berm.

2.4.1.6 Catch Basin Number 1

A total of 14 subsurface samples were collected (at depths ranging from 3 feet bgs to 32 feet bgs) from four locations around Catch Basin Number 1. COC contaminant concentrations in the samples ranged from 10.5 mg/kg to 24,699 mg/kg with a median of 3,185 mg/kg. All but three of the samples had COC concentrations that exceeded the on-site cleanup levels.

2.4.2 1999 Initial PRP RD Sampling

As part of “hot spot” sampling performed in accordance with the ROD, 17 surface soil samples were collected from locations identified by the PRP as having a high potential for the presence of contamination. Total COC concentrations ranged from 4 mg/kg to 210 mg/kg with a median result of 27 mg/kg.

In addition to the surface soil samples, the PRP collected 15 samples from soil borings installed to the north of the facility fence line. These borings included one that extended down into the Potomac Formation to a depth of 104 feet bgs. Five more subsurface samples were collected as part of monitoring well installation activities along the southern and northern edges of the Red Lion Creek, and one subsurface sample was collected during the installation of a monitoring well on the Air Products property located to the west of the facility fence line.

According to data provided in the PRP’s Remedial Design Investigation Report, contaminants were found in all of these samples, but only four samples (collected from three locations) had COC concentrations exceeding the 33 mg/kg limit specified for off-site cleanup. The samples with elevated COC levels were collected from locations SB-1 (24 to 26 feet bgs), SB-7 (10 to 12 feet bgs and 24 to 26 feet), and SB-8 (34 to 36 feet bgs). The maximum total concentration of COCs detected in any one of these samples was 40.56 mg/kg (CRA, 2000).

2.4.3 BVSPC RD Sampling Activities

Beginning in November 2002, BVSPC collected soil and sediment samples as part of RD efforts related to the contingency remedy for the SCD site. The main purposes of this sampling effort were to further delineate the extent of Site contamination, to determine the accuracy and usability of data from the previous site investigations, to provide input for an ongoing ecological risk assessment (ERA), and to fill any gaps in the previously gathered data.

As part of BVSPC's sampling efforts, approximately 140 surface soil and sediment samples have been collected from locations within the facility fence line, in the Western Drainage Gully, on and around the two soil piles, from adjacent "background" areas, and throughout the tributary wetlands area. Of these samples, 14 were submitted for dioxin analysis (results pending) in accordance with the EPA-recommended Dioxin Sampling plan. All of the remaining samples were submitted for VOC and SVOC analysis, with the majority of them also being analyzed for pesticides and PCBs. To date, results have been received for all but the 14 dioxin samples, three surface soil samples, and ten wetlands sediment samples.

In addition to the surface soil and sediment samples, 36 subsurface soil samples were collected from the Western Drainage Gully, the tributary wetlands, and various locations within the facility fence line. These samples were all analyzed for VOCs and SVOCs. Results have been received for all of these samples.

2.4.3.1 Facility and Drainage Gully Characterization Results

Facility Surface Soil Sampling: Between November 19 and November 21, 2002, BVSPC sampled seventeen surface soil locations on the SCD Facility. Sample locations were selected to further delineate the extent of contamination from the 1981 and 1986 release pathways (sample prefix SS) and to make a preliminary survey of facility soil contamination that is not related to either of these spills (sample prefix LT). The results from the LT samples will be analyzed to determine whether a more in-depth study (such as a formal Remedial Investigation) is needed at the Site. All samples were collected from the 6 to 12 inch depth interval with stainless steel spoons and were sent to EPA Contract Laboratory Program labs for analysis. Sample locations were flagged and coordinates were obtained using a Garmin[®] global positioning system (GPS).

Site related contaminants were detected in all of the collected samples. According to the validated sample data, only two facility SS samples – from the drainage ditch next to the rail siding and from the northern end of the Eastern Drainage Ditch – exceeded one or both of

the onsite cleanup criteria (625 mg/kg Total COCs and 450 mg/kg 1,4-Dichlorobenzene). One additional sample collected from the Eastern Drainage Ditch (location SS-07) had total COC concentrations in excess of the 33 mg/kg off-site cleanup level. While none of the LT samples had contaminant concentrations in excess of the onsite cleanup numbers, five of these samples did exceed off-site soil and sediment number. The most contaminated of these – collected from location LT-03 – also contained tentatively identified dioxins, including 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) at 1.5 mg/kg. A follow-up dioxin-specific sample was recently taken at LT-03, but the results have not yet been reported by the lab.

Arochlor 1242 – a polychlorinated biphenyl (PCB) – was detected in two samples from the rail siding area (SS-01 and SS-08) and in all three samples from the Eastern Drainage Ditch (SS-05A, SS-06A, and SS-07). The highest concentrations were detected in samples SS-05A and SS-06A from the northern end of the Eastern Drainage Gully (13.0 mg/kg and 1.5 mg/kg, respectively) and one sample (SS-01) from the Rail Siding Area (4.0 mg/kg). All remaining detections were less than 1 mg/kg.

Contaminant of concern (COC) data from the analyses of the facility surface soil samples collected as part of the RD are presented in Table 1. Figure 2 shows the locations of these facility surface soil samples along with the total concentration of COCs detected in each sample.

Western Drainage Gully Sampling: As part of the surface soil sampling effort described above, BVSPC personnel collected three surface soil samples from locations (SS-02A, SS-03A, and SS-04) along the Western Drainage Gully. COCs were detected in all three samples at concentrations ranging from 0.038 mg/kg to 1.262 mg/kg. PCBs were detected in two samples from this area (SS-02A and SS-03A) at concentrations less than 1 mg/kg. Contaminant of concern (COC) data from the analyses of the Western Drainage Gully surface soil samples are presented in Table 1. Figure 3 shows the locations of the Western Drainage Gully surface soil samples collected as part of the RD along with the total concentration of COCs detected in each sample.

Subsurface Soil Sampling: Between December 19, 2002 and January 10, 2003 Vironex, Inc. (Vironex) of Wilmington, DE – under the direction of BVSPC – completed eleven soil borings at the Site. Vironex utilized a 5410 Geoprobe® direct push rig and a DT66 Geoprobe® direct push track mounted rig. A 4 foot (ft) long macro core sampler containing a disposable acetate liner and equipped with a closed piston was used to collect discrete soil cores continuously from ground surface to the desired total depth for each borehole. Figure

4 is a site map that depicts the locations of these soil borings.

BVSPC field screened each soil core using a photo ionization detector (PID) with an 11.4 EV lamp to determine sample collection zones. In the event that no elevated PID readings were noted, the BVSPC field geologist determined zones of interest based on lithology, water bearing zones, and visible contamination. A total of 21 soil samples were collected from the soil borings, and shipped to a USEPA designated CLP laboratory.

Logs of the soil borings were recorded in the field book and transposed to BVSPC soil boring forms. Table 2 presents a summary of selected field data from each borehole.

COC data from soil boring samples collected as part of the RD are summarized in Table 3. Total COC concentrations detected in each soil boring sample are also presented on Figures 2 and 3. The data from these samples show that relatively high levels of contamination exist in the subsurface underlying a number of areas across the Site.

Results from samples collected in the area of Catch Basin 1 (SB-2, SB-3, SB-4, and SB-5) indicate that substantial contamination has found its way into the subsurface underlying this feature. All six of the samples collected from depths of 34 feet (ft) or less in this area had total COC concentrations exceeding the 625 mg/kg cleanup level specified for onsite soils. COCs were also detected in two deeper samples from this area – collected at depth intervals of 56 to 60 ft and 68 to 72 ft – but at lower levels (total concentrations of 495.86 mg/kg and 15.49 mg/kg, respectively).

Analysis of three samples collected from two borings (SB-1 and SB-9) installed at the southern and northern ends of the facility's rail siding revealed contamination at levels below both the onsite and off-site cleanup numbers. These results are contrary to what was expected given the elevated PID readings that were observed in the soil cores from which these samples were taken.

Relatively low concentrations (total concentrations of 1.02 mg/kg or less) of Site related contaminants were also detected in samples collected from beneath the southern portions of the Eastern Drainage Ditch. Heavier contamination (2,381.6 mg/kg total COCs) was evident in a sample collected from between 68 and 72 ft below the northern extent of the Eastern Drainage Ditch.

Analysis of samples collected from two locations (SB-10 and SB-11) at depths of 4 to 8 ft in the Western Drainage Gully revealed contamination levels in excess of the 33 mg/kg off-site cleanup level specified in the Record of Decision (ROD). A sample collected from a deeper interval (20 – 24 ft) in this area only slight contamination (0.079 mg/kg total COCs).

No PCBs were detected in any of the subsurface soil samples collected using the Geoprobe[®].

2.4.3.2 Soil Pile Area Characterization Results

Samples were also collected around and from within the two soil piles containing excavated materials from the initial 1986 spill response. Results from the samples collected within the soil piles will be used to develop treatment schemes and requirements. The results of samples collected from the areas around the soil piles will help determine whether contaminant migration has occurred in the area and to delineate the required area of remedial action.

One grab sample (analyzed for volatile organic compounds) was collected from each pile using stainless steel spoons. Composite samples were also collected from each pile and analyzed for semivolatile organic compounds and polychlorinated biphenyls (PCBs). Grab samples were collected from three locations (SS-09, SS-10, and SS-13A) considered to be potential runoff areas around the soil piles. Additional samples (SS-11 and SS-12, respectively) were collected from an access road leading to the smaller of the two soil piles (Soil Pile 2) and from the approximate former location of a third soil pile (previously combined with piles 1 and 2).

As anticipated, analysis of the soil pile samples revealed extremely high levels of contamination (41,965 mg/kg total COCs in Soil Pile 1 and 60,699 mg/kg total COCs in Soil Pile 2). In addition, two of the three runoff area samples showed considerable contamination, but only sample SS-10 (located downgradient of Soil Pile 1) exceeded the cleanup level for off-site soils. Neither sample SS-11 nor SS-12 revealed any significant contamination upon analysis. PCBs were not detected in the soil pile samples, but Arochlor 1242 was detected downgradient of the piles at locations at SS-10 and SS-13A (2.20 mg/kg and 0.360 mg/kg, respectively). Summarized Soil Pile area COC data is presented on Table 1 and total COC concentrations are shown – with their respective sample locations – on Figure 4.

2.4.3.3 Wetlands Characterization Results

In all, sediment samples have been collected from 64 locations in the tributary wetlands area. Results have been received for all but ten of these locations. At each location, samples were collected from between 0 and 12 inches below ground surface using hand augers. This method was used due to the extensive presence of organic matter on the wetland surface. All samples were analyzed by EPA-designated Contract Laboratory Program (CLP) labs for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides,

and polychlorinated biphenyls (PCBs).

Because of the elevated levels of sediment contamination observed in previous investigations and a general lack of subsurface data in the tributary wetlands, subsurface samples were collected from four locations (WD-01 through WD-04) in the wetlands. Based on the results of these samples, additional subsurface samples were collected from 12 locations (WD-05 through WD-16) throughout the tributary wetlands. The subsurface wetlands samples were all collected from depths of between 1 to 2 ft bgs and 9 to 10 ft bgs (average depth of approximately 6 ft bgs) using hand augers. At each one foot interval, material retrieved from the auger was scanned with a PID. Augering continued until refusal or until no additional material could be retrieved. The sample was then collected from the material that had exhibited the highest PID reading.

COC data for sediment samples collected from the wetlands area are included on Table 4. COC data for subsurface wetlands samples is included on Table 3. All wetlands sampling locations and their respective total COC data are presented on Figure 4.

North of the Containment Berm: Analytical results confirm that while contamination is wide-spread in the tributary wetlands, it is generally heaviest in the area between the northern edge of the tributary wetlands containment berm (the berm) and the confluence of the tributary and Red Lion Creek. Samples from 33 of 40 locations in this area had total COC concentrations in excess of the 33 mg/kg cleanup level specified in the ROD. PCBs were detected in 17 of the samples collected from this area with a maximum concentration of 0.93 mg/kg. Arochlors 1232, 1242, and 1260 were detected in one or more of these samples.

Suspensions that the contaminants had migrated northward beyond the line of the former silt fence were also confirmed by the results of the sampling in this area. Because of elevated total COC concentrations observed in many samples collected from locations near the line of the former silt fence, two rounds of additional sampling were conducted to the north of the silt fence line in an effort to delineate the northern boundary of the sediment contamination. The first additional round consisted of 10 samples (SD-60 through SD-69) collected between approximately 25 and 50 feet north of the silt fence line. Total COC concentrations in these samples ranged from 31.48 mg/kg to 2,134.78 mg/kg, with concentrations in all but one of the samples exceeding the off-site cleanup level. Based on these results, a second round of sampling – consisting of 10 samples located approximately 25 and 50 feet north of the previous set – was conducted. Preliminary results from these samples revealed total COC concentrations in seven of the 10 samples exceeded the off-site cleanup limit.

Discounting one heavily contaminated sample that returned a flawed result of COC concentrations greater than 1,000,000 mg/kg, the average concentration of COCs in all sediment samples collected from locations to the north of the berm was approximately 998.7 mg/kg.

Subsurface sampling in this area revealed extensive contamination at depth. Ten of the 11 subsurface samples collected from locations north of the berm had COCs present at levels in excess of the off-site soil and sediment cleanup level established in the ROD. Total COC concentrations in these samples ranged from 4.06 mg/kg to 15,542.65 mg/kg with an average of approximately 4,530 mg/kg.

South of the Containment Berm: To the south of the berm, none of the six RD sediment samples that were collected within 120 ft of the berm had COC concentrations greater than the off-site cleanup number, but PCBs were detected at an average concentration of 0.53 mg/kg in four of the six samples. PCBs detected in this area included Arochlors 1248, 1254 and 1260. Most of these six samples were collected in areas where data gaps were observed in the data from previous investigations.

Heavier sediment contamination was found between 120 and 250 ft south of the berm. Eight of the 11 sediment samples collected in this area had total COC concentrations greater than the off-site cleanup number, and Arochlor 1260 was detected at low concentrations (0.17 mg/kg and 0.19 mg/kg) in two samples. The average concentration of COCs detected in sediment samples from this area was 125.7 mg/kg.

COCs were also found at concentrations above the off-site cleanup level in a sediment sample collected approximately 450 ft south of the berm. This confirms data from earlier investigations suggesting that this area would require remedial action. No PCBs were detected in this area.

Evidence of contamination was also found at depth in the three subsurface samples collected in the areas south of the berm. Total COC concentrations in all three of these samples exceeded the 33 mg/kg cleanup level, but the average concentration (approximately 270 mg/kg) was significantly lower than that of the samples collected to the north of the berm.

Base of the Western Drainage Gully: Eleven sediment samples were collected from the ponded area surrounding the base of the Western Drainage Gully. Most of the sample locations in this area were selected in an attempt to fill observed data gaps from earlier investigations and further delineate the extent of the projected remedial activities. None of these samples exceeded the off-site cleanup number (total COCs ranged from 0.03 mg/kg to

5.55 mg/kg), but Arochlor 1260 was detected in eight of the samples (average concentration 0.13 mg/kg).

COCs were detected at concentrations exceeding the off-site cleanup level in both subsurface samples collected in this area. As was the case in the area immediately south of the berm, the average concentration (approximately 155 mg/kg total COCs) was significantly lower than that of the samples collected from the area to the north of the berm.

3.0 Project Criteria

3.1 Soil and Sediment Remedial Objective

The ROD for the SCD Site sets the following objectives for the contingency soil/sediment remedy:

- Remediate soils and sediments to levels that are protective of human health and the environment;
- Minimize infiltration, run-on, and run-off of precipitation to areas containing subsurface contaminated soils and sediments;
- Monitor and maintain the integrity of Catch Basin #1 to ensure that it does not serve as a continuing source of contamination to subsurface soils and groundwater;
- Reduce toxicity of the sediments to aquatic organisms; and
- Reduce bioaccumulation of contaminants.

Because there are no chemical specific applicable or relevant and appropriate requirements (ARARs) that establish cleanup levels for the Site's soils and sediments, EPA used the results of human health and ecological risk assessments to establish acceptable exposure levels and the onsite and off-site cleanup levels listed in the ROD (see Table 3-1). The ROD also stipulates that all treated soils and sediments must pass Toxicity Characteristic Leaching Procedure (TCLP) analysis before they can be used as backfill at the Site or subjected to land disposal.

Table 3-1 ROD Listed Cleanup Criteria

Material	Concentration of Total COCs (mg/kg)	Concentration of 1,4-Dichlorobenzene (mg/kg)
Onsite Soils	625	450
Off-Site Soils	33	N/A
Soil Piles	33	N/A
Off-Site Sediments	33	N/A

N/A – Not Applicable

Note: All excavated materials must pass TCLP analysis before land disposal.

It is important to note that certain aspects of the ROD (including onsite cleanup levels, excavation limits around Catch Basin #1, and the capping of the rail siding area) were based on the assumption that the Site would remain an operating chemical production facility. As a result of Metachem's subsequent bankruptcy and abandonment of the Site, these issues will most likely be revisited by EPA and DNREC officials. Because no official determination regarding these issues has been made at this point, the existing ROD guidelines and limits were used in the development of this study.

3.2 Preferred Remedial Alternative

Five remedial alternatives (multiple options for thermal treatment and bioremediation alternatives) for soils and sediments were presented in the ROD. EPA evaluated these alternatives as well as the No Action Alternative against the nine criteria specified in the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) at 40 CFR 300.430 (e)(9)(iii). Based on their evaluation, EPA originally selected ex-situ/in-situ bioremediation as the remedy for the Site with a contingency remedy of low temperature thermal desorption (LTTD). Because of a lack of evidence showing that the bioremediation alternative would be effective, the EPA made LTTD the preferred remedial alternative for the Site's soils and sediments in March 2002. The LTTD alternative involves the following components:

- Excavation of soils along the Western Drainage Gully (to a depth of 7 feet) that exceed the 33 mg/kg Total COC off-site cleanup limit.
- Excavation of contaminated soils and sediments contained in the two Soil Piles and the Sedimentation Basin located to the north of the facility fence line together with contaminated materials (that exceed the 33 mg/kg limit) underlying and surrounding these features.
- Removal of resident wildlife from wetlands areas prior to excavation of wetlands sediments and soils.
- Excavation of all sediments and soils that exceed the 33 mg/kg limit from the unnamed tributary and surrounding wetlands.
- Excavation of soils along the Eastern Drainage Ditch (to a depth of 3 feet) and surrounding Catch Basin #1 (to a depth of 15 feet) that exceed either the 625 mg/kg total COC or 450 mg/kg 1,4-dichlorobenzene onsite cleanup limits.
- Treatment of all excavated materials via LTTD at temperatures necessary to remediate them to the appropriate cleanup levels.
- Recovery and treatment of all product and liquids resulting from storage and

- preparation of excavated materials in a manner consistent with the ARARs.
- Recovery and treatment of LTDD air emissions through the use of an afterburner, carbon adsorption, or some other manner consistent with the ARARs.
 - Testing of all treated materials to ensure compliance with ROD cleanup criteria and appropriate land disposal restrictions.
 - Backfilling and regrading excavated areas with treated Site material or other fill meeting the all ARARs.
 - Installation of low permeability asphalt caps in the areas of Catch Basin #1 and the Rail Siding.
 - Reestablishment of wetlands areas that were affected by remedial activities.
 - Stabilization of upland areas and banks surrounding the wetlands areas in accordance with substantive state sedimentation and erosion control requirements.
 - Control of storm water runoff (in accordance with ARARs) from all areas of soil disturbance related to remediation activities.
 - Ecological monitoring for five years to establish that remedial objectives have been met.
 - Additional work as dictated by EPA.

This 15% design document provides initial coverage of the above components with the exception of the long term monitoring. Because this document is intended to serve as a comparison between onsite and off-site treatment of soils and sediments, emphasis is placed on those aspects of treatment where significant differences exist between the two options.

3.3 Preliminary Soil Excavation/Treatment Volume

Soil excavation and treatment volumes would be the same for either treatment alternative. Characterization studies conducted as part of this RD indicate that the volume of soils and sediments that will require treatment is substantially greater than reported in the Feasibility Study (FS) Report. Based on information from the RI and FS Reports as well as the RD Data Acquisition effort, it is projected that approximately 126,300 cubic yards of soil and sediment will require excavation and treatment as part of the Site remedial activities. This is approximately four times the estimate presented in the FS Report. Table 5 shows a breakdown of the currently projected soil/sediment excavation volumes together with a corresponding breakdown from the FS Report. The areal extents of the projected excavations are presented in Figure 5 (Facility Excavation Extents) and Figure 6 (Non-Facility Excavation Extents).

The bulk of the change in excavation/treatment volume can be attributed to the increased depth to which contamination was detected in the wetlands area. Whereas the FS Report used a wetlands excavation depth of one foot for volume calculations, RD sampling found total COC concentrations exceeding the off-site cleanup criteria in samples collected from as deep as 10 feet bgs (the depth limit of the manual augering method employed in this area). Based on the analytical and related field screening (PID) results, it is projected that excavation to an average depth of approximately 7 feet bgs will be required in those areas of the wetlands where treatment is required.

Additionally, while the FS Report calculations used the line of the former silt fence as the northern tributary wetlands excavation boundary (except for location SD-4), RD sampling showed that contamination was present at concentrations greater than the cleanup criteria in all but four of the 20 samples collected to the north of this line. Only preliminary data is available for these samples at this time. In addition, the ultimate northern extent of the required wetlands excavation has not yet been identified in all areas. Primarily for these reasons, a conservative average northern limit of 125 feet to the north of the silt fence line will be used for volume estimates until a more complete determination of the northern extent can be achieved.

The areal increase in soil/sediment excavation to the north of the berm is partially offset by a projected decrease in the area requiring excavation to the south of the berm. The maps presented in the FS Report and the ROD appear to indicate that almost all tributary wetlands surface sediment located between the southern edge of the berm and a line approximately 350 feet to the south of the berm would require excavation and treatment. Results from RD sampling and a review of data from the RI seem to indicate that some sediments on the western side of this area and sediments located between 250 and 350 feet to the south of the berm might not require excavation.

Where no data was available that specifically contradicted that presented in the FS Report, the estimates (and supporting assumptions) from that report have been used here. As was the case in the FS Report, a 10% overexcavation factor has been included in the volume calculations. Volumes listed for the rail siding area in the FS Report were not included in the study estimates because the ROD stipulates that this area will not be excavated as part of the remedial activities. This limitation – as well as those regarding maximum excavation depths – will most likely be lifted or modified given the fact that the facility has since been abandoned. Once it is determined to what depth this and other affected areas are to be excavated, the volume estimates will be updated.

4.0 Alternatives Analysis

4.1 Overall Project Description

Regardless of whether onsite or off-site treatment is selected, the overall approach to completing the remedial action at the SCD Site will consist of the following five major components:

- Mobilization/demobilization of the project;
- Site preparation;
- Excavation and dewatering (as needed) of contaminated materials;
- Treatment of contaminated materials; and
- Backfilling and site restoration.

Other project areas that merit consideration are the restrictions/limitations resulting from federal, state, and local laws, the transportation of the excavated material to the treatment location, site safety/security, and the impact that the project will have on the surrounding populace and environment.

4.1.1 Mobilization/Demobilization

Mobilization and demobilization of the project will include moving necessary equipment, materials and personnel to the site in preparation for the project and transporting them from the project site following completion of the work. Because various aspects of the project will be commencing at different times, there will be multiple mobilizations to and demobilizations from the Site. Coordination of these activities will be necessary to avoid unnecessary operational delays.

4.1.2 Site Preparation

Although the materials slated for removal from locations inside the facility fence line are readily accessible, the vast majority of the soils and sediments that are being removed are located in the wetlands and wooded areas located to the north and west of the facility. Consequently, substantial site preparation work will be required at the Site before excavation can begin.

General clearing and grubbing will be required in many portions of the wooded and wetlands areas located to the north and northwest of the facility fence line. Temporary decontamination pads will be required to limit the spread of contamination from excavation

areas, and support/containment pads will be needed for treatment/dewatering equipment and soil storage. Temporary construction/excavation roads will be needed to enable equipment to access the wetlands areas surrounding the unnamed tributary. In addition, existing haul roads located to the north of the facility fence line will be upgraded (to support two way construction traffic) and new roads added in some areas. Sedimentation and erosion control measures will have to be put in place to limit the impact of construction-related activities, and site utilities will have to be extended to the project work areas.

4.1.3 Excavation and Dewatering

These aspects of the proposed project are basically independent of whether treatment is performed onsite or off-site. The selected excavation approach will depend on the terrain surrounding the contaminated material, the depth of the required excavation, and the presence (or absence) of nearby structures. Excavation of most upland and facility soils is expected to be accomplished using standard industry techniques. However, the nature of the tributary wetlands area makes it difficult to safely excavate to any significant depth without first implementing an effective dewatering strategy. The high moisture content of the materials being excavated from the tributary wetlands and the Sedimentation Basin also means that these materials will require dewatering prior to treatment or off-site transportation.

As mentioned above, maps outlining projected excavation extents are included as Figures 5 and 6 in this document. Because of the involved explanations regarding these methods, a separate excavation and dewatering summary is included in Appendix B of this document.

4.1.4 Treatment of Contaminated Materials

As stated previously, treatment of the contaminated materials will be accomplished through the use of a LTTD system. Thermal desorption technology treats the soil in two steps. First, the soil is heated, desorbing the contaminants from the soil, and then the desorbed contaminants are captured and/or destroyed. This treatment technology is used in lieu of incineration because contaminants are destroyed or recovered not in the soil matrix but in the off-gas.

Regardless of where the material will be treated, the nature of the material being treated must be considered in selecting the LTTD treatment system. The SCD contaminated soil is a RCRA-listed waste that also contains relatively low levels of PCBs [no samples exceeded the 50 ppm Toxic Substances Control Act (TSCA) threshold]. Dioxins have also been tentatively identified in certain samples collected from the Site, but results from dioxin-

specific analyses have not been received as of yet. Because of the high concentrations of chlorinated organics in the waste, system operators will need to take precautions (such as the addition of lime to the treatment system feed) to minimize the effects of acidic compounds generated during treatment. In addition, care will be required to minimize potential dioxin formation and to ensure that any dioxins in the excavated materials (or resulting from the treatment process) are captured and/or destroyed (to a 99.9999% level) in the treatment system. Measures will also be required to control/capture particulates resulting from the treatment process and to minimize dust from the storage and movement of treated materials. Finally, regular sampling/analysis of treatment system emissions and perimeter air monitoring will be performed to meet expected air permit equivalency requirements and to provide information to the local community.

4.1.5 Backfilling and Site Restoration

After excavations have been completed and confirmation sampling has been performed to show that COC concentrations at the excavation limits are below the ROD-specified cleanup levels, each excavated area will be backfilled with material that meets the cleanup level for that area (i.e., onsite limit for onsite areas and off-site limit for off-site areas). Backfilling of all Site excavations will be accomplished by placing appropriately treated (in the case of onsite treatment) and tested material in 8 inch lifts and compacting the fill using two passes of a sheepsfoot or wobbly wheel roller. All backfilled areas will be stabilized in accordance with State erosion and sedimentation control requirements.

In backfilling excavated areas, care will be required to ensure that treated material does not become contaminated through contact with unexcavated materials. In areas where ROD-specified depth limits have prevented excavation of all contaminated soils, a geotextile or some other low permeability liner will be placed in the excavation prior to backfilling to prevent contact with the contaminated materials. In the wetlands area, the volume of material requiring treatment will necessitate backfilling portions of the excavation prior to completion of the entire wetlands excavation. To minimize potential cross-contamination, backfill will only be placed in those areas where acceptable confirmation data has been received, and a gap of at least 20 ft will be left between backfilled portions and areas awaiting excavation.

Temporary polyethylene liners might also be used to further limit the potential for contact in this area.

Wetlands excavation areas will be backfilled and compacted to within two to three feet of original grade (depending on the available volume of treated material), and a minimum of

two inches of suitable top soil will be placed prior to planting with appropriate water-tolerant annual species. Natural succession with phragmites control will be used to reestablish the wetlands following the initial planting. All wetlands restoration efforts will be performed in accordance with Section 404 of the Clean Water Act.

The excavation surrounding Catch Basin #1 will be backfilled and compacted to within approximately 11 inches of grade. A low permeability asphalt cap consisting of two 1.5 inch asphalt courses over approximately 8 inches of crushed aggregate will be installed over the Catch Basin #1 excavation area. A similar pad will be installed in the Rail Siding area.

Other excavation areas (e.g., Eastern Drainage Ditch, Western Drainage Gully, Soil Piles) will be backfilled and graded to meet the surrounding terrain. After the demobilization of the treatment/dewatering equipment from the Site, support/containment pads will be decontaminated, and unless it is determined that they are needed for subsequent remedial purposes (e.g., groundwater treatment plant placement), they will be removed and the underlying soil will be regraded and planted with appropriate ground cover.

4.1.6 Legal Considerations

The Remedial Action Contract Scope of Work under which this report has been prepared requires a detailed statement of how all applicable or relevant and appropriate (ARARs) and Federal and State public health and safety environmental requirements and standards will be met. A review of ROD-listed and previously unidentified ARARs was performed to identify any potential impediments to implementation of the specified LTTD treatment alternative. A complete listing of ARARs and potential ARARs that were in place at the time the ROD was signed is provided in Table 10 of the ROD, and all remedial action work will be conducted in accordance with those ARARs as well as any others identified subsequent to the signing of the ROD.

Section 121(d)(2)(A) of CERCLA incorporates into law the CERCLA Compliance Policy that specifies that Superfund remedial actions must meet any federal standards, requirements, criteria, or limitations that are determined to be legally requirement ARARs. In addition, any promulgated state regulation, standard, criteria, or limitation that is more stringent than the corresponding federal regulation, standard, criteria, or limitation must be adhered to during the remedial action for the Site. Federal statutes applicable to the SCD site include the following:

- Clean Air Act (CAA),
- Clean Water Act (CWA), and
- Resource Conservation and Recovery Act (RCRA).

Some of the applicable state statutes for the SCD site include the following:

- Delaware Coastal Zone Act;
- Delaware Ambient Air Quality Standards;
- Delaware Wetlands Regulations;
- Delaware Regulations Governing Hazardous Substance Cleanup; and
- Delaware Regulations Governing Hazardous Waste.

A more detailed review of the ARARs and their impacts on the design and remedial process will be provided in the subsequent design submissions.

4.1.7 Material Transportation

By definition, the onsite and off-site treatment options will have different transportation requirements. In both cases, every effort will be made to ensure that traffic flow patterns will minimize the potential for contaminant migration. Because of the locations and sizes of the excavation areas and the limited areas available for access to the wetlands portion, it will not be possible to prevent contaminated soil/sediment haul routes from crossing any clean soil haul routes. As mentioned above, temporary decontamination pads will be constructed at the entrance/exit of the wetlands area as well as at each excavation area to limit the spread of contaminants from these areas. Contaminated soil on tire treads will be removed at these decontamination areas before the truck is allowed to traverse the Site.

4.1.8 Site Safety/Security

All remedial activities will be completed safely and in accordance with all Occupational Safety and Health (OSHA) standards governing worker safety during hazardous waste operations (29 CFR Parts 1904, 1910, and 1926). To ensure compliance with these standards, a complete Site and activity specific health and safety plan (HASP) will be developed prior to commencement of Site remedial activities. No remedial activities will begin until this HASP has been submitted to and approved by EPA. All workers entering onto the Site during remedial activities will be required to read the HASP and signify their understanding of its requirements by signing the document. In addition, daily activity-specific safety briefings will be conducted prior to the commencement of each shift's work. As it is projected that a portion of the Site work will be conducted after dark, the remediation/excavation contractor will be required to supply appropriate lighting for all work areas.

During remedial activities, temporary fencing will be constructed around open/active excavations to provide a measure of safety for construction personnel and local residents. Appropriate signage will be placed around the perimeter of the Site to alert local residents as

to the potential hazards associated with the remedial activities. The treatment system/dewatering equipment pad will be fenced (with locking access gates) to minimize the potential for unauthorized access. All access gates will be locked during those hours that the facility/treatment system is unoccupied. During operational hours, security personnel will be limited to those currently stationed at the entrance gate to the Site. During hours when the facility is unoccupied additional security personnel will be utilized to prevent unauthorized access to work areas.

4.1.9 Public and Environmental Impacts

Both the onsite and off-site treatment alternatives will impact local citizens and the environment to varying extents.

As with any construction project of this size, project-related traffic, light (in the case of work performed after dark), and noise have the potential to impact the surrounding community. Because the site is located among industrial properties and is at least one-half mile from the nearest residence, the onsite construction operations should have little impact on the surrounding community. Site terrain features (gullies and wooded areas) should also provide natural sound and light breaks to further minimize the onsite project impacts.

The primary environmental impacts in each case will be destruction and reestablishment of the tributary wetlands, alteration of groundwater flow in the wetlands area, potential site runoff, and removal of contamination from the Site soils and sediments. The tributary wetlands are currently overrun with phragmites australis and contaminated with COCs. Following excavation and treatment of the soils and sediments from this area, the wetlands will be reestablished with more beneficial plantings. Consequently, the temporary disruption of this area is not projected to have a negative long-term impact.

Similarly, although groundwater flow in the area will be disrupted during the project, the majority of the areas flow pattern will be reestablished during the wetlands reestablishment phase. Given that groundwater flow entering the wetlands from the east is a source of contamination impacting the wetlands, it is likely that this portion of the groundwater flow will not be restored (at least in the short term). The contaminated groundwater entering from the east will be remediated as part of the interim groundwater remedy for the site.

Site runoff will be controlled through implementation of a site stormwater and sediment management plan in accordance with the Delaware Sediment and Stormwater Regulations.

4.2 Onsite Treatment Alternative Description

To ensure that this project is completed in the most cost-effective manner, a rigorous bidding/selection process will be conducted. Potential remediation subcontractors will be evaluated based on many criteria including their ability to carry out the RA, their relative projected cost for completion, and effective utilization of small and small disadvantaged business for second-tier subcontracting.

Once the subcontractor team is in place, mobilization to the Site will begin so that necessary site development/preparation work can be quickly accomplished. Initial site development work will focus on establishment of sediment and erosion controls, upgrading of access roads north of the facility fence line, and installation of the pads and utilities necessary for operation of the dewatering and treatment equipment.

Based on discussions with various LTTD vendors, it is anticipated that a containment pad with dimensions of approximately 150 ft by 100 ft will be required to support the LTTD/dewatering equipment and store excavated materials awaiting treatment. An additional containment/storage area (approximately 50 ft by 150 ft) will be constructed adjacent to the treatment pad to store treated materials. In addition to providing storage space, these pads will provide containment and will be constructed to allow capture and recovery of contaminated runoff. After balancing minimization of overall travel distance from the excavation locations to the treatment area with minimization of site preparation required for pad construction and the desire to minimize the spread of Site contaminants, it was decided that the pad will be constructed on a level portion of the wooded area located to the north of the existing Sedimentation Basin.

It is expected that the LTTD unit will be fueled by natural gas (3 inch line) and will require a 480 volt electrical hookup as well as connection to a potable water supply (3 inch line) supplying at least 25 gallons per minute. The dewatering system will also require a 480 volt connection. All of these utilities are currently available on site. As discussed in Appendix B, water recovered from the dewatering of excavated materials will have to be treated before being discharged. A pump and temporary transfer line (to move the recovered water to the facility WWTP or a separate treatment system) will therefore have to be installed along with the utility lines.

Once the existing access roads have been upgraded and erosion controls have been put in place, installation of the temporary wetlands access roads and construction of the wetlands excavation containment/support structures (see Appendix B) will be undertaken. To minimize cross traffic between trucks carrying contaminated and treated materials, separate

roads will be installed for transport of treated materials in the upland areas. Preliminary site preparation details for the Onsite alternative are presented together with preliminary traffic flow patterns on Figure 7.

Because the upland soils are readily accessible for the most part, it is expected that excavation and treatment of contaminated materials will begin before the site preparation work is completed in the wetlands area. Consequently, mobilization of the dewatering and treatment system equipment will be scheduled to commence soon after the completion of the necessary access roads and support pads and installation of required utilities. It should be noted that procuring dewatering equipment of the type expected to be used here typically involves lead times as long as five months. This will have to be taken into account in the procurement and scheduling processes. Mobilization of the treatment system equipment is anticipated to take approximately four to eight weeks with an additional two weeks required for system prove out.

Excavated soils and sediments will be transported by dump truck to the treatment system support/containment pad where they will be handled using dedicated front-end loaders. Traffic patterns have been established to minimize (where possible) cross traffic between trucks hauling untreated and treated materials. Soils excavated from the wetlands and Sedimentation Basin areas will then be dewatered using a rotary press (or similar equipment). Although soils from most upland areas are not expected to require dewatering, all soils and sediments will require some preparation prior to treatment.

LTDD treatment vendors surveyed for this study have indicated that the material must generally be a maximum of 2 inches in diameter for effective treatment. The soils and sediments from the Site are generally sandy in nature, and it is not expected that significant amounts of material would require size reduction. However, it is possible that oversize tree roots and undocumented industrial debris will be encountered during excavation. Depending on the composition of the material, oversized objects will be decontaminated and disposed of off-site (concrete and steel) or crushed and fed into the treatment system.

After oversized material is removed, the screened material is typically deposited on a scale and weighed (the order of the weighing, dewatering, and sizing operations depends on the vendor). Although vendors prefer to use a weigh scale to determine pricing (all potential vendors provided unit treatment cost estimates on a per ton basis), BVSPC experience indicates that in-situ volume is the best method of calculating payment. In-situ volume would be preferable because this method is unrelated to weigh scale accuracy, and because moisture content, moisture added, and re-run materials do not have to be subtracted from the

total treated soil.

Properly sized material will then be conveyed into the LTTD system. LTTD systems typically use a screw conveyor or similar feature to move the contaminated material into the primary treatment unit (PTU). Although there are several variations of the LTTD system, all the systems can basically be divided into direct-fired and indirect-fired systems. The PTU defines the two types of LTTD systems.

The direct-fired type introduces the heating source (flame) directly into the primary treatment chamber. The PTU on an indirect fired LTTD system is heated externally and the material being treated never comes into direct contact with the flame. Both types of systems remove contaminants by heating the soil to temperatures of between 200°F and 1000°F.

When exposed to the heat of the PTU, the contaminants desorb from the material and a carrier gas transports them to a secondary treatment unit (STU). Direct-fired systems typically utilize heated air as a carrier gas while indirect-fired systems typically use nitrogen to limit the available oxygen in the PTU and thus minimize the risk of fire. Once contaminants reach the STU, they are either destroyed or directed to a contaminant capture system depending on the site and material requirements.

STUs in which the contaminants are destroyed typically employ a thermal oxidizer or afterburner (1,600-2,000°F) which is followed by an emissions control system consisting of a quench tower, baghouse and scrubber. In these units, all of the off-gas from the unit's PTU is directed to the oxidizer and treated before being discharged.

The contaminant capture systems employed on some indirect-fired LTTD units typically include a scrubber, condensing stage, particulate filters, and vapor phase granular activated carbon (GAC). The carrier gas conveys the desorbed contaminants and water vapor from the PTU to a scrubber and condensing stage where the majority of the contaminants and water vapor are removed. The remaining contaminants and the carrier gas are typically circulated back to the PTU. Prior to the STU, approximately 10% of the contaminant/carrier gas mixture is diverted to a vapor phase GAC system, treated and discharged as to the atmosphere. The condensed/captured liquid is separated into an organic phase and a water phase (with soluble organics). The water phase is treated with liquid phase carbon and is then discharged or used to rehydrate the treated soil (to minimize dust problems). The organic phase condensate is shipped off-site for treatment (typically at a RCRA-permitted incinerator).

No matter which type of treatment system is employed, an air permit equivalency will have to be obtained from DNREC. In addition, air emissions from the system and Site perimeter

air quality will have to be monitored in accordance with the requirements of the permit equivalency. Monitoring of dioxin emissions would be included under these requirements. The surveyed LTTD vendors have stated that the condensing STUs on their systems are capable of meeting the 99.9999% destruction removal efficiency (DRE).

It appears that the use of an onsite direct-fired LTTD system and/or a thermal oxidizer to treat off-gas from an onsite indirect-fired LTTD system may be prohibited because of provisions in the Coastal Zone Act (7 Delaware Code, Chapter 70, Section 7003) and Environmental Control (7 Delaware Code, Chapter 60, Sections 6002 – 6003) Chapters of Delaware state regulations. Section 7003 states that, “Heavy industry uses of any kind not in operation on June 28, 1971, are prohibited in the coastal zone and no permits may be issued therefor.” Incinerators are currently considered heavy industry for purposes of this law. In addition, Section 6002 states that incinerators are defined as, “any structure or facility operated for the combustion (oxidation) of solid waste”. This same Section defines Solid Waste to include, “discarded material, including solid, liquid, semisolid or contained gaseous material resulting from industrial, commercial, mining and agricultural operations, and from community activities.” Finally, portions of Section 6003 prohibit issuance of a permit to any “incinerator” on any property that is located within three miles of any residence, residential community, church, school, park, or hospital. The SCD Site does not meet these restrictions, and a direct-fired LTTD system – or a system that uses a thermal oxidizer for off-gas treatment – placed there would most likely not meet the substantive requirements of these sections of the Delaware regulations.

Because of the restrictions on placement of incinerators in Delaware and the potential for an oxidizer to be classified as an incinerator, it is likely that any onsite system would have to be an indirect-fired unit utilizing a contaminant capture STU. During our survey of LTTD system vendors, multiple treatment vendors with mobile indirect-fired, contaminant capture LTTD systems capable of treating the excavated materials onsite were identified.

Based on the estimated volume of soil that would require treatment and the capacities/throughputs of the various systems, it is projected that approximately 24 to 30 months would be required to treat all of the excavated materials from the Site. This figure assumes an average throughput of between 16 and 20 tons/hour, with 16 hour days, six day work weeks, a 90% run time and a total treatment volume of 130,000 cubic yards. Treatment throughput could be increased – and treatment time decreased – if a second treatment system is mobilized to the Site. Addition of a second unit would be dependent on system and space availability. Because the vendor-specified treatment costs and utility costs for the systems are tied to the amount of material treated, the only additional costs from the second system

would be related to site preparation, permitting, and system mobilization/demobilization. Mobilization and testing of onsite equipment is projected to take an additional 6 to 10 weeks and demobilization 3 to 6 weeks.

Following treatment, the treated material will be stored in covered piles on the treated material storage pad adjacent to the treatment system pad (See Figure 7). The treated material will be tested to ensure that it meets the cleanup criteria and is suitable for use as backfill. Samples will be collected at the rate of one sample for every 125 cubic yards of treated soil/sediment and sent to EPA-selected CLP laboratories for TCL organics (plus those COCs not on the TCL) analysis and toxicity characteristic leaching potential (TCLP) analysis. The selected sample rate will result in at least two samples per day (assuming a 17 cubic yard/hour treatment rate and a 16 hour day) but can be modified depending on observed field conditions and subsequent EPA and DNREC input. Only material for which Total COC concentrations are below the cleanup criteria and that passes TCLP land disposal restrictions will be used as backfill. Material that fails either analysis will be retreated and retested (if feasible). Material that fails one or both tests and can not be retreated in the LTTD system will be manifested as hazardous waste and transported off-site for treatment at a RCRA-permitted facility.

Backfilling and site restoration activities will be performed as described in Section 4.1.5 of this study. Whenever possible, each excavation will be backfilled with treated material from that area. Backfilling of areas will generally be performed in the same order that they were excavated and will proceed as treated materials become available. Capping of the rail siding and Catch Basin #1 areas will be completed following the backfilling of the Catch Basin excavation.

4.3 Off-Site Treatment Alternative Description

As with the Onsite alternative, a rigorous bidding process will be conducted to choose the remediation subcontractor(s) for the project if the Off-site alternative is selected. To avoid mobilization delays, procurement of the dewatering equipment required for the project should begin as soon as possible after a subcontractor(s) is chosen. This is necessary because of the long lead times typically associated with this type of equipment.

The mobilization effort will also be similar to that described for the Onsite alternative, except that the treatment system component will not be required. In addition to establishing sediment and erosion controls and upgrading of access roads north of the facility fence line, initial site development work will involve the construction of a rail loading area. In addition,

temporary decontamination pads will be constructed adjacent to each excavation area as well as at the entry/exit point of the wetlands area.

This rail loading area will be constructed along the rail siding between the existing warehouse facility and the existing tank-truck loading facility. To accommodate the loading area, some overhead piping and certain concrete foundation/containment features (unused) will have to be removed. Tanks adjacent to the proposed loading area currently use the overhead piping that is being contemplated for removal. Consequently, if these tanks are still in use when the pad is constructed, this piping might have to be rerouted.

Once this pad is constructed it would be possible to begin excavation and loading of certain upland area soils. While this would help decrease the overall project time, careful coordination of traffic and resources would be required because of the site preparation work that would still be underway in the wetlands and wooded areas north of the fence line.

No site development related to an LTDD system is needed under the Off-site alternative, but soils and sediments from the wetlands and Sedimentation Basin areas will still need to be dewatered prior to transport. Consequently, a support/containment pad will have to be constructed and a 480 volt electric line will have to be installed along with potable water lines (for decontamination purposes), water recovery, and water treatment features (see Appendix B). The dewatering pad will be constructed on a level portion of the wooded area located to the north of the existing Sedimentation Basin. Placement of the dewatering pad at this location (instead of at the rail loading area) will necessitate extra handling of the material, but it will also help to minimize the potential spread of contaminants during transportation of wetlands and Sedimentation Basin materials. To allow transfer of the recovered water to the facility WWTP (or a separate treatment system) a pump and temporary transfer line will also be installed. Mobilization of the dewatering equipment can begin as soon as the containment pad and associated utilities and transfer/treatment measures are in place.

Once the existing access roads north of the facility fence line have been upgraded, installation of the temporary wetlands access roads and construction of the wetlands excavation containment/support structures (see Appendix B) will be undertaken. Preliminary site preparation details for the Onsite alternative are presented together with preliminary traffic flow patterns on Figure 8.

Excavation will be performed using long reach excavators as described in Appendix B. As in the Onsite alternative, dump trucks will be used to move excavated soils and sediments around the Site. Upland soils will be transported directly to the rail loading area, any

oversized industrial debris (e.g., steel, concrete) will be removed, and the soils will be loaded onto rail hopper cars using a front end loader. Industrial debris will be decontaminated (if possible) and disposed of at an appropriate off-site facility. Sediments from the Sediment Basin and soils and sediments from the wetlands areas will be taken from the excavation area to the dewatering support/containment pad where they will be dewatered using a rotary press (or similar equipment). Dewatered sediments and soils will then be loaded onto dump trucks and transported to the rail loading area. All shipments will be manifested as hazardous waste and shipped by rail to an off-site treatment facility. Shipping of all wastes will be performed in accordance with applicable hazardous waste shipping regulations.

Off-site transportation via truck was considered, but it was eliminated because of the estimated number of trips required to transport the excavated material and the distance to the nearest identified off-site treatment facility. Specifically, it is estimated that delivery of all excavated materials would require in excess of 8,000 round trips of approximately 1,540 miles apiece. Conversely, the projected volume of excavated materials would fill over 1,600 rail cars that could be linked together to limit the total number of individual train loads departing the Site.

During BVSPC's vendor search, no currently operating off-site LTTD systems were identified that are available to treat the waste material that will be generated as part of the remedial activities at the SCD Site. Based on subsequent discussions with representatives of the EPA and the Agency for Toxic Substances and Disease Registry (ATSDR), BVSPC determined that there are no stationary LTTD systems in the United States that are permitted to treat RCRA-listed hazardous waste of the type that will be generated at the SCD Site. A Canadian vendor (located in St. Ambroise, Quebec) with a direct-fired rotary kiln desorption system (initial desorption temperature range of approximately 1,100°F – 1,400°F) that is permitted to treat Site-related wastes was identified. This system employs a thermal oxidizer STU. Because of the treatment temperatures in the PTU, the Canadian facility's system is not classified as a LTTD system. It should be noted that this system already has customers and most likely could not be dedicated to treating only waste from the SCD Site.

The ROD specifies that treatment of soils and sediments will be accomplished through the use of a LTTD system. Unless the specified treatment method is expanded to include incineration, no U.S. facility will be available to treat the excavated material. Even using the facility that has been identified in Canada would require modification of the ROD because the facility's PTU operates at temperatures greater than the range (200°F to 1,000°F) currently specified in the ROD.

In the event that the ROD is amended to allow treatment in the higher temperature range, it appears that the 1994 North American Free Trade Agreement (NAFTA) – while not covered in the ROD – would allow the export of hazardous wastes (such as those from the Site) to Canada for treatment. However, although the identified Canadian facility is permitted (under Canadian regulations) to treat hazardous waste of the type that exists at the SCD Site, Canadian facilities are not permitted under RCRA.

If the Canadian facility is determined to be acceptable, manifesting and transportation of the hazardous wastes would have to meet the requirements of both U.S. and Canadian law. In addition, appropriate customs declarations and Certificates of Origin would be required for each shipment leaving the country.

Following removal of contaminated material (and successful confirmation sampling) from an excavation area, backfilling and Site restoration activities would begin in that area. Thus, backfilling will be underway in some areas while excavation is still ongoing in others. All backfilling and site restoration activities will be conducted as described in Section 4.1.5 of this study.

Because the excavated material will be taken off-site for treatment, new fill will have to be purchased locally and transported to the Site. It is estimated that in excess of 8,000 dump trucks of certified clean fill would be required to adequately backfill the various excavations on the Site. To prevent the off-site spread of site-related contaminants, the wheels and undercarriage of all delivery trucks will be thoroughly decontaminated prior to leaving the Site. Water from all decontamination activities at the site will be collected and pumped to the existing facility WWTP (if available) or the dewatering carbon adsorption system.

Alternative sources of clean fill may be dredge material that may be available from commercial ship berthing facilities or USACE maintained navigation channels. This alternative has not been thoroughly researched for this study, but it is possible that material could be placed hydraulically in the wetlands area, mitigating a portion of the truck traffic and decontamination requirements.

4.4 Alternative Comparison

Both of the considered alternatives would result in removal of the contamination from the Site, but each of the two discussed alternatives offers certain advantages and disadvantages.

4.4.1 Mobilization/Demobilization

The mobilization efforts for the two alternatives are similar in many respects as both efforts

will require the similar equipment and materials for the road construction, excavation, dewatering, and capping portions of the project. Both alternatives will require close coordination and substantial planning to allow overlapping tasks to be completed successfully.

The Onsite alternative will require the mobilization testing and demobilization of a treatment system, but because these tasks will overlap with other required activities, they should not impact the overall length of the project. However, because project progression in the Onsite alternative will be dictated by the throughput capability of the onsite treatment system, overall time on site is expected to be longer than in the Off-site alternative. If necessary, it might be possible to utilize a second LTDD system (if space and system availability allow) to increase throughput and decrease time on site.

While the off-site alternative does not require the mobilization of a treatment system, the scheduling of arrivals and departures for over 1,600 railcars and over 8,000 dump trucks would require significant coordination.

4.4.2 Site Preparation

Site preparation requirements will be relatively similar under the two possible treatment alternatives. The primary identified differences between the two alternatives in this area involve utility connections, road installation, and the construction of support/containment pads.

Operation of an onsite treatment system would necessitate the installation an extra utility connection (for natural gas) and additional capacity for the potable water supply. In addition, it is anticipated that additional access roads (dedicated for transport of treated material) would be installed in the onsite alternative. Finally, although the treatment system pad and treated material pad would only be needed for the onsite alternative, construction of the rail loading area and dewatering area pad needed for the off-site alternative would involve approximately the same effort.

4.4.3 Excavation and Dewatering

Because excavation rates under the off-site alternative will not be limited to the rate of an onsite treatment system, it is expected that excavation would progress at a faster rate with this option. However, the need to perform confirmation sampling and the anticipated variations in maximum excavation depths in the wetlands will reduce this advantage somewhat. Furthermore, adding a second onsite treatment system (if system and space availability permit) would increase the treatment throughput and could make up any

difference between the two alternatives. Other than this, neither alternative appears to hold any significant advantage in this area.

4.4.4 Treatment of Contaminated Materials

Based on vendor information, all of the proposed indirect-fired onsite systems and the direct-fired off-site treatment system will treat the contaminated materials to the desired cleanup levels. Vendor information also indicated that these systems will also achieve 99.9999% DRE necessary for dioxins.

If onsite treatment is selected for the Site, the total duration of work performed at the SCD site will be dependent on the achievable throughput of the treatment system. Because soils can be stored at the off-site treatment facility, the duration of onsite work under the off-site alternative will instead be largely dictated by the rate at which material can be excavated and transported off-site. As mentioned in Section 4.4.3, while this might result in a shorter period of site activities, other factors (e.g., confirmation sampling excavation, depth uncertainties, and possible addition of a second onsite treatment system) could reduce or negate this advantage.

From a cost perspective, initial vendor quotes indicate that the per ton treatment cost for off-site treatment (excluding transportation) was more than twice that of onsite treatment.

4.4.5 Backfilling and Site Restoration

The one major difference separating the two alternatives in the area of excavation backfilling and site restoration is the need to procure clean fill material under the off-site alternative. Not only does this increase the costs of this alternative (by approximately \$1,000,000), but the volume of certified clean fill that will be required might make it difficult to obtain suppliers within a reasonable distance of the site. Even if nearby sources can be identified, the logistics of arranging the approximately 8,000 dump truck deliveries will require substantial effort. If the off-site alternative is selected, further study would be required to investigate sources of backfill material. Dredge material may be a lower cost alternative.

4.4.6 Legal Considerations

Obtaining the necessary permits to place an LTTD system at the Site might present some difficulties. Although indirect-fired units equipped with condensing STUs are not typically considered incinerators, the fact that Delaware's regulations have been modified to prohibit the placement of an incinerator in much of the state might indicate that there could be opposition to placement of a thermal treatment system at the Site.

Because of the emissions from an onsite treatment system, air permit equivalency requirements for the Onsite alternative would be substantially greater than those for off-site treatment. Monitoring of treatment system emissions would require additional sampling and additional analysis costs.

While using off-site treatment would avoid the difficulties associated with placing and monitoring the LTTD treatment system, it would bring into play other regulatory obstacles. Primary among these is the fact that the only identified stationary thermal desorption facility that is currently permitted to treat hazardous waste of the type found at SCD operates outside the temperature range specified in the ROD. Use of this system would therefore require modification of the ROD.

In addition, manifesting requirements for the off-site alternative would be substantially greater than those for onsite treatment because the entire volume of contaminated soils and sediments would be shipped to Canada. This would entail the manifesting of over 1,600 railcars of waste and would alternative and would require adherence to both U.S. and Canadian hazardous waste shipping regulations.

Finally, the appropriateness of using a Canadian facility that is not permitted under RCRA to treat hazardous wastes generated at a Superfund site is questionable. No precedence for using such a facility during a Fund-Lead Superfund cleanup was found during this comparison study. In addition, it is likely that the public perception of the exporting of hazardous waste to make use of such a facility would not be favorable.

4.4.7 Material Transportation

Because there are no RCRA-permitted stationary LTTD units currently operating in the United States, the off-site alternative would require that materials be transported over 750 miles to the nearest treatment facility in Canada. Even when taking into account the reduced number of total trips that rail transport (as opposed to truck transport) would entail, movement of materials for off-site treatment greatly increases the potential for spreading contamination beyond the Site boundaries. Potential sources for contaminant releases during transportation include the derailment of loaded railcars, release of excess moisture from railcars, and wind-transport of contaminated materials from improperly contained materials during transit and off-site storage.

The off-site alternative also requires additional travel within the site boundaries. Contaminated materials located within the facility fence line are located in close proximity to the rail loading area, but those materials located in the wetlands and the wooded areas to the

north of the fence line (constituting over 85% of all of the contaminated materials) are much closer to the proposed location of the onsite treatment system than the facility rail siding area. Consequently, it is estimated that over the course of the project contaminated materials would be transported over 1,700 additional miles within the site boundaries if the off-site alternative is selected. In addition, empty trucks returning from the rail loading area and trucks delivering clean fill from off-site will travel a total of over 8,000 additional onsite miles under the off-site alternative. Aside from requiring greater fuel usage, this additional traffic increases the potential of onsite accidents and the spread of contaminated materials across the Site. Finally, decontamination of the fill delivery trucks will result in significant wastewater generation and require additional effort.

4.4.8 Site Safety and Security

Because the off-site option removes the actual soil treatment function from the Site, it is anticipated that local security and safety requirements would be reduced somewhat for this alternative.

4.4.9 Public and Environmental Impact

Although LTDD treatment vendors have indicated that their mobile systems would meet all potential air permit equivalency requirements, the off-site alternative removes this potential emissions source from the Site. This emissions source would not, however, be eliminated but would simply be moved to northern Quebec.

Additionally, the need to transport all of the contaminated material off-site and bring in replacement fill would substantially increase site-related traffic in the surrounding area. As mentioned above, initial estimates suggest that in excess of 1,600 rail cars (or over 8,000 dump trucks) would be required to remove the soil over the course of the project and an additional 8,000 dump trucks would be required to transport clean fill to the Site. Although this area does have a substantial industrial presence, the access roads to the facility pass residential, commercial, and agricultural properties, and the increased traffic would most likely be viewed negatively by the surrounding community. Furthermore, although measures would be in place to minimize dust emissions during transit, it is anticipated that the off-site transport of contaminated materials would result in some spread of site contaminants (through dust emissions) along the travel route.

The primary negative impact of the onsite alternative for the surrounding community is that site work would most likely continue for a longer period of time than if the material is transported off-site for treatment. As mentioned previously, it is possible that the overall

project duration of the onsite alternative could be reduced through the addition of a second LTTD system.

The removal of the treatment activity from the Site would lessen the incremental noise and light pollution (relative to onsite treatment) at the Site, but given the presence of natural sound/light breaks (e.g. trees, terrain) and the distance to the closest residence (at least one-half mile) their impact on the local population during either option is expected to be minimal.

5.0 Preliminary Cost Estimate

Comparison level RA construction cost estimates were prepared for each alternative using M-CACES for Windows Release 1.2C. A copy of the M-CACES Summary Pages for each treatment alternative is provided in Appendix C. The detail pages contain further breakdown levels but have not been included in this report.

Although the cost projected by the ROD for the remediation of the SCD Site was approximately \$17.1 million, the increased volume of wetlands sediments that will require treatment and the extra site preparation measures that will be required to excavate the deeper wetlands contamination have resulted in substantially higher projected costs than those anticipated in the ROD. Table 5-1 provides the total remedial action costs for each alternative as projected by M-CACES. Had the wetlands excavation volume estimates assumed in the FS Report (maximum excavation in the wetlands approximately one ft) been used in the M-CACES estimate, the projected costs for the two alternatives would have been approximately \$14.6 million for onsite treatment and approximately \$33.9 million for off-site treatment.

Table 5-1
Preliminary Cost Estimate

Projected Remediation Costs – Onsite Treatment Alternative	\$ 56,517,318
Projected Remediation Costs – Off-site Treatment Alternative	\$ 125,360,413

Because of the significantly higher than anticipated costs, BVSPC – at the direction of EPA – has begun investigating alternative treatment methods that might hold the potential of lowering the overall cost of treatment and restoration for the Site. Because of the high percentage of the total cost that is attributable to treatment of the wetlands area soils and sediments, the investigation has been centered on technologies that could address soils/sediments from that area. An initial screening process has indicated that in-situ chemical oxidation holds promise as a treatment method that could address soils and sediments from the wetlands and Sedimentation Basin areas at substantially lower costs than those projected with LTTD. In addition, in-situ chemical oxidation holds promise as a method of treating the contaminated deep subsurface soils observed at during subsurface

sampling conducted within the facility fence line. BVSPC will be submitting a treatment technology addendum to the study that will cover the potential effectiveness and costs of this technology.

6.0 Preliminary Remedial Action Schedule

A preliminary RA construction schedule is presented in Appendix C. Although ongoing developments regarding the status of the Site and the ROD make it difficult to identify an accurate project start date, June 2004 was assumed for purposes of this preliminary schedule. The start date and the overall schedule will be update as the project progresses.

7.0 Conclusions

If implemented successfully, either alternative would result in the removal of contamination from those areas where such removal is specified in the ROD.

Largely because no appropriately permitted stationary LTTD facility currently operates in the United States, it has become clear that onsite treatment would be a much more cost-effective method of treating wastes excavated from the SCD Site. Aside from the fact off-site treatment is estimated to cost approximately \$69.1 million more than onsite treatment, disadvantages including increased site-related traffic, greater potential for the spread of site-related contaminants, increased manifesting and logistics requirements, and uncertainties surrounding the use of a non-RCRA permitted facility call into question the practicality of the off-site alternative to fulfill the requirements of the ROD.

That said, the onsite alternative is not without certain difficulties. Permitting and operation of an onsite treatment system in the Coastal Zone of Delaware will require close cooperation with state and local officials. In addition, an extensive community relations effort will most likely be needed to win community support for such a project. Even with these potential challenges, it appears that the onsite treatment alternative represents a superior choice when compared with off-site treatment.

Information gathered during this study reveals that implementation of either of the proposed LTTD treatment alternatives would pose significant challenges and would cost significantly more than what was estimated in the ROD. Consequently, it would seem appropriate to investigate other treatment technologies that could potentially replace or supplement LTTD in the remediation of the SCD Site. An initial review of one such alternative technology (in-situ chemical oxidation) will be submitted as an addendum to this document.

8.0 References

ATSDR, 2003. *Petitioned Public Health Assessment, Metachem Products, LLC (a/k/a Standard Chlorine of Delaware, Incorporated), New Castle, New Castle County Delaware (Public Comment Release)*. Agency for Toxic Substances and Disease Registry. January 31, 2003.

CRA, 2000. *Remedial Design Investigation Report and Preliminary Design Report for Interim Groundwater Remediation Program, Standard Chlorine of Delaware Site*. Conestoga-Rovers & Associates. March 2000.

CRA, 2001. *Supplemental Remedial Design Investigation Report and Preliminary Design Report for Interim Groundwater Remediation Program, Standard Chlorine of Delaware Site*. Conestoga-Rovers & Associates. September 2001.

Weston, 1992. *Remedial Investigation Report, Standard Chlorine of Delaware, Inc. Site Delaware City, Delaware*. Roy F. Weston, Inc., September 1992.

Weston, 1993. *Feasibility Study Report, Standard Chlorine of Delaware, Inc. Site Delaware City, Delaware*. Roy F. Weston, Inc., May 1993.

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June 13, 2003

TABLES

**Standard Chlorine of Delaware
Design Comparison Report
Table 1**

SAMPLE NAME	SC-LT01		SC-LT02		SC-LT03		SC-LT04		SC-LT05		SC-LT06		SC-LT07	
CLP SAMPLE_NAME	C0EA4		C0EA0 & C0E99		C0EA5		C0F73 & 74		C0F75 & 76		C0E98		C0E96	
SAMPLE_DATE	21-Nov-02		20-Nov-02		21-Nov-02		05-May-03		05-May-03		20-Nov-02		20-Nov-02	
Northing	583034.4573		583142.6564		583141.4545		583157.5		582612.7		582540.2		582484.1786	
Easting	594567.9289		594544.4529		594285.1758		594915.3		594915.5		594859.0		594806.788	
LOCATION	Facility		Facility		Facility		Facility		Facility		Facility		Facility	
Total COCs	0.713		0.115		545.8		0.104		31.42		35.904		66.17	
1,4-Dichlorobenzene	0.01	U	0.003	J	1	J	0.003	M	0.97	J	6.8		11	
Benzene	0.01	U	0.01	U	3.2	U	0.01	M	1.9	U	0.95	U	1.5	U
Nitrobenzene	0.36	U	0.37	U	1.5	U	0.37	U	0.2	U	0.054	J	0.44	U
Toluene	0.01	U	0.01	U	3.2	U	0.01	M	1.9	U	0.95	U	1.5	U
Chlorobenzene	0.01	U	0.01	U	3.2	U	0.002	M	1.9	U	0.16	J	2.9	
1,2-Dichlorobenzene	0.01	U	0.01	U	1.7	J	0.001	M	0.85	J	1.1	J	9.9	
1,3-Dichlorobenzene	0.01	U	0.01	U	3.2	U	0.01	M	1.9		0.22	J	7.8	
1,2,3-Trichlorobenzene	0.2	NJ			7.1	NJ					2.7	NJ	4.2	NJ
1,2,4-Trichlorobenzene	0.01	U	0.002	J	38		0.003	M	26		3.6		11	
1,3,5-Trichlorobenzene	0.1	NJ			35	NJ								
1,2,3,4-Tetrachlorobenzene	0.39	NJ	0.11	NJ	380	NJ					10	NJ	8.1	NJ
1,2,4,5-Tetrachlorobenzene					78	NJ					11	NJ	11	NJ
Pentachlorobenzene														
Hexachlorobenzene	0.023	J	0.37	U	5		0.065	J	1.7		0.27	J	0.27	J
SAMPLE NAME	SC-LT01		SC-LT02		SC-LT03		SC-LT04		SC-LT05		SC-LT06		SC-LT07	

Note - A blank concentration value indicates that the compound was not detected.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

L - Value May Be Biased Low

Note - All data in this table reflect validated results, excepting samples SC-LT04, LT05 and LT10.

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SAMPLE NAME	SC-LT08		SC-LT10		SC-LT11		SC-LT12		SC-LT13		SC-LT14		SC-LT15	
CLP SAMPLE_NAME	C0E97		C0F72		C0EA9		C0EA7		C0EA6		C0EB0 & C0EB1		C0EA8	
SAMPLE_DATE	20-Nov-02		05-May-03		21-Nov-02		21-Nov-02		21-Nov-02		21-Nov-02		21-Nov-02	
Northing	582434.5989		582453.1		582653.9292		582370.3089		582544.4065		582837.6597		582696.3516	
Easting	594731.5305		594482.0		594609.0776		594315.007		594347.0206		594595.0976		594556.368	
LOCATION	Facility		Facility		Facility		Facility		Facility		Facility		Facility	
Total COCs	171.42		48.225		6.611		12.719		213.323		1.058		3.304	
1,4-Dichlorobenzene	3.1	B	0.033	M	0.01	J	0.004	J	0.004	J	0.013		0.004	J
Benzene	16	U	0.006	M	0.012	U	0.001	J	0.01	U	0.004	J	0.014	U
Nitrobenzene	0.46	U	5.7	U	0.35	U	0.37	U	0.37	U	0.35	U	1.7	U
Toluene	16	U	0.005	M	0.012	U	0.01	U	0.01	U	0.01	U	0.014	U
Chlorobenzene	16	U	0.004	M	0.001	J	0.01	U	0.003	J	0.018		0.003	J
1,2-Dichlorobenzene	16	J	0.025	M	0.005	J	0.004	J	0.003	U	0.008	J	0.001	J
1,3-Dichlorobenzene	16	U	0.014	M	0.002	J	0.002	J	0.002	U	0.004	J	0.002	J
1,2,3-Trichlorobenzene	19	NJ			1.4	NJ	5.5	NJ			0.11	NJ	0.73	NJ
1,2,4-Trichlorobenzene	91		0.014	M	0.003	J	0.008	J	0.011		0.005	J	0.004	J
1,3,5-Trichlorobenzene	34	NJ			1.2	NJ			1.5	NJ	0.006	NJ	1.2	NJ
1,2,3,4-Tetrachlorobenzene	8.1	NJ			3.5	NJ	6.2	NJ			0.53	NJ	0.92	NJ
1,2,4,5-Tetrachlorobenzene									1.8	NJ	0.26	NJ		
Pentachlorobenzene														
Hexachlorobenzene	0.22	J	48		0.49		1		210	+	0.1	J	0.44	J
SAMPLE NAME	SC-LT08		SC-LT10		SC-LT11		SC-LT12		SC-LT13		SC-LT14		SC-LT15	

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Table 1**

SAMPLE NAME	SC-SS01-F		SC-SS02A-F		SC-SS03A-F		SC-SS04-F		SC-SS05A-F		SC-SS06A-F		SC-SS07-F	
CLP SAMPLE_NAME	C0E84		C0E92		C0E91		C0E90		C0E95		C0E94		C0E93	
SAMPLE_DATE	20-Nov-02		20-Nov-02		20-Nov-02		20-Nov-02		20-Nov-02		20-Nov-02		20-Nov-02	
Northing	582733.712		583310.1704		583333.4942		583261.9904		583137.4313		582950.3123		582602.4367	
Easting	594119.681		593864.2901		593939.6694		594090.9755		594833.2983		594824.3195		594829.2142	
LOCATION	Facility		W Gully, bottom		W. Gully, N. bank		W. Gully, S. Bank		Facility		Facility		Facility	
Total COCs	9680.45		1.262		0.166		0.038		1781.8		7.209		43.645	
1,4-Dichlorobenzene	1300	+	0.016		0.024		0.006	B	150	U	0.011	B	3.9	
Benzene	5	U	0.012	U	0.015	U	0.014	U	150	U	0.017	U	1.5	U
Nitrobenzene	0.37	U	0.41	U	0.43	U	0.45	U	0.48	U	0.46	U	1.8	U
Toluene	5	U	0.012	U	0.002	J	0.005	J	150	U	0.017	U	1.5	U
Chlorobenzene	5	U	0.002	J	0.002	J	0.014	U	150	U	0.002	J	3	
1,2-Dichlorobenzene	670	+	0.01	J	0.009	J	0.014	U	150	U	0.007	J	0.84	J
1,3-Dichlorobenzene	260	+	0.005	J	0.004	J	0.014	U	150	U	0.003	J	0.005	J
1,2,3-Trichlorobenzene	1300	NJ	0.31	NJ	0.013	NJ			410	NJ			8.1	NJ
1,2,4-Trichlorobenzene	6100	+	0.018	B	0.02	B	0.017	B	1100		0.007	B	1.8	
1,3,5-Trichlorobenzene	16	NJ	0.39	NJ			0.01	NJ					14	NJ
1,2,3,4-Tetrachlorobenzene	34	NJ	0.44	NJ							6.6	NJ	12	NJ
1,2,4,5-Tetrachlorobenzene									270	NJ				
Pentachlorobenzene														
Hexachlorobenzene	0.45	J	0.071	J	0.092	J	0.45	U	1.8		0.59		1.8	U
SAMPLE NAME	SC-SS01-F		SC-SS02A-F		SC-SS03A-F		SC-SS04-F		SC-SS05A-F		SC-SS06A-F		SC-SS07-F	

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SAMPLE NAME	SC-SS08-F		SC-SS09-F		SC-SS10-F		SC-SS11-F		SC-SS12-F		SC-SS13A-F	
CLP SAMPLE_NAME	C0E89		C0E75		C0E81		COE74		C0E79 & C0E80		C0EB2	
SAMPLE_DATE	20-Nov-02		19-Nov-02		19-Nov-02		19-Nov-02		19-Nov-02		21-Nov-02	
Northing	583163.6677		583419.4193		583642.2902		583708.9646		583857.2018		583849.6336	
Easting	594120.9699		594067.2713		594000.5969		594223.4678		594340.9347		594124.3539	
LOCATION	Facility		Wooded, near SP1		Wooded, bank dg of SP-1		Wooded, off main road		Wooded, off road		Wooded, bank of wetland	
Total COCs	2.14		0.008		114		0		0.002		16.825	
1,4-Dichlorobenzene	0.11		0.002	B	19		.01	U	0.002	B	0.003	J
Benzene	0.013	U	.01	U	1.2	U	.01	U	.01	U	0.012	U
Nitrobenzene	0.4	U	0.38	U	4.2	U	0.33	U	0.41	U	0.42	U
Toluene	0.013	U	.01	U	1.2	U	.01	U	.01	U	0.012	U
Chlorobenzene	0.013	U	.01	U	1.2	U	.01	U	.01	U	0.012	U
1,2-Dichlorobenzene	0.005	J	.01	U	1.2	U	.01	U	.01	U	0.012	U
1,3-Dichlorobenzene	0.003	J	.01	U	1.2	U	.01	U	.01	U	0.012	U
1,2,3-Trichlorobenzene	0.4	NJ			1	NJ						
1,2,4-Trichlorobenzene	0.022		.01	U	4.2		.01	U	.01	U	0.002	J
1,3,5-Trichlorobenzene	1.2	NJ			17	NJ					5.1	NJ
1,2,3,4-Tetrachlorobenzene	0.16	NJ	0.006	NJ	63	NJ					11	NJ
1,2,4,5-Tetrachlorobenzene					9.8	NJ						
Pentachlorobenzene												
Hexachlorobenzene	0.24	J	0.38	U	4.2	U	0.33	U	0.41	U	0.72	
SAMPLE NAME	SC-SS08-F		SC-SS09-F		SC-SS10-F		SC-SS11-F		SC-SS12-F		SC-SS13A-F	

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SAMPLE NAME	SC-SS14-F		MCSP01		MCSP02	
CLP SAMPLE_NAME	C0EA2		C0EH5 & C0EH6		C0EH7&C0EH8	
SAMPLE_DATE	21-Nov-02		12/19/2002		12/19/2002	
Northing	582320.2271		Composite from		Composite from	
Easting	594131.4439		Soil Pile #1		Soil Pile #2	
LOCATION	Facility		Soil Pile #1		Soil Pile #2	
Total COCs	0		41965		60699	
1,4-Dichlorobenzene	0.01	U	41000		60000	
Benzene	0.01	U	0.21	U	0.5	U
Nitrobenzene	0.37	U	0.33	U	0.33	U
Toluene	0.01	U	0.21	U	0.5	U
Chlorobenzene	0.01	U	0.21	U	0.21	U
1,2-Dichlorobenzene	0.01	U	310	J	0.5	U
1,3-Dichlorobenzene	0.01	U	0.21	U	0.5	U
1,2,3-Trichlorobenzene						
1,2,4-Trichlorobenzene	0.01	U	570	B	650	B
1,3,5-Trichlorobenzene						
1,2,3,4-Tetrachlorobenzene						
1,2,4,5-Tetrachlorobenzene			61	JN	39	JN
Pentachlorobenzene			24	JN	10	JN
Hexachlorobenzene	0.37	U	0.33	UJ	0.33	UJ
SAMPLE NAME	SC-SS14-F		MCSP01		MCSP02	

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Table 2 - Selected Borehole Field Data

Borehole ID	Northing	Easting	Total Depth	Water Observations	Max PID with Depth of Reading
SB-01	594173.9	582372.9	32	Damp, 16'	1500 ppm 24' – 32'
SB-02	594454.5	582718.9	56	Damp, 14'	>2000 ppm 16' -56'
SB-03	594523.1	582784.8	32	Wet, 16'	150 ppm 28' -32'
SB-04	594496.8	582801.1	60	Not Noted	300 ppm 24' -28'
SB-05	594418.3	582741.7	72	Not Noted	450 ppm 42'
SB-06	594829	582648.4	68	Damp, 16'	0.0 ppm
SB-07	594837.6	582917.6	68	Wet, 36''	0.0 ppm
SB-08	594849.8	583114.5	72	Wet, 36'	0.0 ppm
SB-09	594134.1	583160.4	52	Wet, 36'	177 ppm 28' – 32'
SB-10	593920.3	583271	24	Wet, 8'	11.7 ppm 16' – 20'
SB-11	593913.4	583326.8	16	Wet, 4'	150 ppm 4' – 8'

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LOCATION			FACILITY													
CHEMICAL NAME	CAS RN	RESULT UNIT	SB-01		SB-02				SB-03				SB-04			
			C0EH4		C0EH9		C0EJ1		C0EJ0		C0EJ4		C0EJ6		C0EJ8	
			12/19/2002		12/19/2002		12/19/2002		12/19/2002		12/20/2002		12/20/2002		12/20/2002	
			29' - 30'		4' - 8'		20' - 24'		Duplicate		12' - 16'		28' - 32'		24' - 28'	
NORTHING			594173.9		594454.5				594523.1				594496.8			
EASTING			582372.9		582718.9				582784.8				582801.1			
VALIDATED Total COCs			7.29		15407.3		15705.03		19309		747.6		22617.6		15258.54	
1,4-Dichlorobenzene	106-46-7	mg/kg	0.27	B	7900		6900		8800		260		15000		9700	
Benzene	71-43-2	mg/kg														
Nitrobenzene	98-95-3	mg/kg					3.0	J			17		11		100	J
Toluene	108-88-3	mg/kg														
Chlorobenzene	108-90-7	mg/kg	5.4				120	J			5.5	J			68	J
1,2-Dichlorobenzene	95-50-1	mg/kg	1.5		4800		5500		6700		140		2200		3300	
1,3-Dichlorobenzene	541-73-1	mg/kg														
1,2,3-Trichlorobenzene	87-61-6	mg/kg					3.9	JN	7.0 JN	JN	17	JN	600	JN	87	DJN
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.12	B	2700		3000		3800		240		4800		2000	
1,3,5-Trichlorobenzene	108-70-3	mg/kg					10	JN	19 JN	JN						
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg					91	JN			25	JN	2.3	JN		
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg					67	JN	44 JN	JN	41	JN				
Pentachlorobenzene	608-93-5	mg/kg			7.3	JN	10	JN	8.5	JN	2.1	JN	2.5	JN	3.4	DJN
Hexachlorobenzene	118-74-1	mg/kg					0.7	J	0.5				1.8	J	0.14	J

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LOCATION			FACILITY															
CHEMICAL NAME	CAS RN	RESULT UNIT	SB-04			SB-05			SB-06			SB-07						
			C0EJ7	C0EJ9		C0EL3	C0EL7		C0EM5	C0EM6		C0EM7	C0EM8					
			12/20/2002	12/20/2002		1/6/2003	1/6/2003		1/6/2003	1/6/2003		1/7/2003	1/7/2003					
			56' - 60'	Duplicate		32' - 34'	68' - 72'		16' - 20'	Duplicate		36' - 40'	Duplicate					
NORTHING			594496.8			594418.3			594829			594837.6						
EASTING			582801.1			582741.7			582648.4			582917.6						
VALIDATED Total COCs			58.244		495.86		5751.468		15.49		1.017		0.01		0.01		0.009	
1,4-Dichlorobenzene	106-46-7	mg/kg	17		16		3200		2.4	B	0.007	B	0.005	B	0.005	B	0.007	B
Benzene	71-43-2	mg/kg	1.2	J	0.76	J			6.5		0.001	B						
Nitrobenzene	98-95-3	mg/kg	0.51		96	J	1.4	J										
Toluene	108-88-3	mg/kg																
Chlorobenzene	108-90-7	mg/kg	21		15		120	J	4.5		1	B					0.002	B
1,2-Dichlorobenzene	95-50-1	mg/kg	12		11		1900		1.5									
1,3-Dichlorobenzene	541-73-1	mg/kg	0.4	J	0.4	J												
1,2,3-Trichlorobenzene	87-61-6	mg/kg			63	JN												
1,2,4-Trichlorobenzene	120-82-1	mg/kg	5.7		7.1		530		0.59	B	0.009	J	0.005	B	0.005	B		
1,3,5-Trichlorobenzene	108-70-3	mg/kg			280	JN												
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg																
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg																
Pentachlorobenzene	608-93-5	mg/kg	0.34	JN	6.4	JN												
Hexachlorobenzene	118-74-1	mg/kg	0.094	J	0.2	J	0.068	J										

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LOCATION			FACILITY						WESTERN DRAINAGE GULLY						WETLANDS	
CHEMICAL NAME	CAS RN	RESULT UNIT	SB-08		SB-09				SB-10				SB-11		MCWD01_010203	
			C0EN0		C0EN2		C0EN3		C0EP6		C0EP5		C0EP4		C0EK2	
			1/7/2003		1/8/2003		1/8/2003		1/10/2003		1/10/2003		1/10/2003		02-Jan-03	
			68' - 72'		28' - 32'		48' -52'		4' - 8'		20' - 24'		4' - 8'		4' - 5'	
NORTHING			594849.8		594134.1				593920.3				593913.4		583395.0	
EASTING			583114.5		583160.4				583271				583326.8		593749.0	
VALIDATED Total COCs			2381.6		0.593		0.077		696.9		0.071		178		109.83	
1,4-Dichlorobenzene	106-46-7	mg/kg	710		0.078		0.032				0.002	B	48		2.5	J
Benzene	71-43-2	mg/kg	30	J			0.006	J							16	
Nitrobenzene	98-95-3	mg/kg	1.6												0.33	U
Toluene	108-88-3	mg/kg													1.2	U
Chlorobenzene	108-90-7	mg/kg	280				0.012	J					1.1	J	91	
1,2-Dichlorobenzene	95-50-1	mg/kg	730		0.015	J	0.003	J					17		1.2	U
1,3-Dichlorobenzene	541-73-1	mg/kg	170						6.9	J			1.9	J	1.2	U
1,2,3-Trichlorobenzene	87-61-6	mg/kg														
1,2,4-Trichlorobenzene	120-82-1	mg/kg	460		0.5		0.024		690		0.069		110		1.2	U
1,3,5-Trichlorobenzene	108-70-3	mg/kg														
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg													0.33	NJ
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg														
Pentachlorobenzene	608-93-5	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg													0.33	U

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Table 3

LOCATION			WETLANDS									
CHEMICAL NAME	CAS RN	RESULT UNIT	MCWD02_121902		MCWD03_010203		MCWD04_010203		MCWD05_031303		MCWD06_031303	
			C0EJ3		C0EK7		C0EK9		C0EZ7		C0EZ9	
			19-Dec-02		02-Jan-03		02-Jan-03		13-Mar-03		13-Mar-03	
					6' - 7'		6' - 7'		4' - 5'		4' - 5'	
NORTHING			583995.0		584609.4		584649.0		584670.6		584637.6	
EASTING			594121.1		594347.9		594322.8		593943.3		594033.1	
VALIDATED Total COCs			51.3		4106		2376.81		10405.8		3678.9	
1,4-Dichlorobenzene	106-46-7	mg/kg	19		1500		1700		8100		1500	
Benzene	71-43-2	mg/kg	1.2	U	1.2	U	1.2	U	1.3	U	22	J
Nitrobenzene	98-95-3	mg/kg	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Toluene	108-88-3	mg/kg	1.2	U	1.2	U	1.2	U	1.3	U	1.3	U
Chlorobenzene	108-90-7	mg/kg	1.2	U	420		330		700		1200	
1,2-Dichlorobenzene	95-50-1	mg/kg	12		80	J	24	J	120	J	62	J
1,3-Dichlorobenzene	541-73-1	mg/kg	3.1		56	J	42	J	75	J	92	J
1,2,3-Trichlorobenzene	87-61-6	mg/kg	2.1	NJ	1100	NJD	0.13	NJ	210	NJD	120	NJ
1,2,4-Trichlorobenzene	120-82-1	mg/kg	11	B	610		130		910		590	
1,3,5-Trichlorobenzene	108-70-3	mg/kg			290	NJD	150	NJ	1.8	J	1.9	J
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg	4.1	NJ			0.29	NJ	230	+	68	+
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg			40	NJ			31		11	
Pentachlorobenzene	608-93-5	mg/kg			10	NJD	0.39	NJ	28		12	
Hexachlorobenzene	118-74-1	mg/kg	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U

Note - A blank concentration value indicates that the compound was not detected.

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

D, + - Result from Diluted Sample

B - Contaminant Present in Blank

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Table 3

LOCATION			WETLANDS									
CHEMICAL NAME	CAS RN	RESULT UNIT	MCWD07_031303		MCWD08_031303		MCWD09_031103		MCWD10_031203		MCWD11_031203	
			C0F00		C0EZ6		C0EY7		C0EZ2		C0EZ0	
			13-Mar-03		13-Mar-03		11-Mar-03		12-Mar-03		12-Mar-03	
			7' - 8'		5' - 6'		5' - 6'		6' - 7'		9' - 10'	
NORTHING			584602.9		584630.2		584329.1		584460.6		584411.1	
EASTING			594070.3		594213.3		594111.6		594232.8		594315.1	
VALIDATED Total COCs			448.12		2998.1		911.71		9121.2		4.6	
1,4-Dichlorobenzene	106-46-7	mg/kg	81		1700		360		2800		1.3	U
Benzene	71-43-2	mg/kg	15	J	19	J	37	J	83	J	1.3	U
Nitrobenzene	98-95-3	mg/kg	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Toluene	108-88-3	mg/kg	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U
Chlorobenzene	108-90-7	mg/kg	280		610		470		1900		4.6	
1,2-Dichlorobenzene	95-50-1	mg/kg	6	J	69	J	15	J	370		1.3	U
1,3-Dichlorobenzene	541-73-1	mg/kg	12	J	58	J	20	J	86	J	1.3	U
1,2,3-Trichlorobenzene	87-61-6	mg/kg	13	NJ	60	NJD	0.4	NJ	560	NJD		
1,2,4-Trichlorobenzene	120-82-1	mg/kg	13	J	450		8.6	J	3000		1.3	U
1,3,5-Trichlorobenzene	108-70-3	mg/kg	0.62		1.1		0.33	U	6.2	J	0.33	U
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg	21	+	22	+	0.47	J	220	+	0.33	U
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg	2.4		4.4		0.13	J	73		0.33	U
Pentachlorobenzene	608-93-5	mg/kg	4.1		4.6		0.11	J	23		0.33	U
Hexachlorobenzene	118-74-1	mg/kg	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U

Note - A blank concentration value indicates that the compound was not detected.

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

D, + - Result from Diluted Sample

B - Contaminant Present in Blank

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Table 3

LOCATION			WETLANDS									
CHEMICAL NAME	CAS RN	RESULT UNIT	MCWD12_031203		MCWD13_031203		MCWD14_031103		MCWD15_031103		MCWD16_031103	
			C0EZ3		C0EZ4		C0EY6		C0EY3		C0EY5	
			12-Mar-03		12-Mar-03		11-Mar-03		11-Mar-03		11-Mar-03	
			2' - 3'		6' - 7'		2' - 3'		9' - 10'		1' - 2'	
NORTHING			584286.3		584516.9		584216.8		584168.6		583430.9	
EASTING			594233.6		594614.6		594030.8		594114.7		593784.6	
VALIDATED Total COCs			237.39		15542.65		222.3		536.95		201.15	
1,4-Dichlorobenzene	106-46-7	mg/kg	15		4900		4.3	J	49		56	
Benzene	71-43-2	mg/kg	24		270	J	88		16	J	50	
Nitrobenzene	98-95-3	mg/kg	0.33	U	9.1		0.33	U	0.33	U	0.33	U
Toluene	108-88-3	mg/kg	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U
Chlorobenzene	108-90-7	mg/kg	160		2200		130	+	420	+	40	
1,2-Dichlorobenzene	95-50-1	mg/kg	2.6	J	5600		1.3	U	12	J	1.3	U
1,3-Dichlorobenzene	541-73-1	mg/kg	6	J	850		1.3	U	25	L	1.3	U
1,2,3-Trichlorobenzene	87-61-6	mg/kg	3.8	NJ	180	NJ					29	NJD
1,2,4-Trichlorobenzene	120-82-1	mg/kg	4	J	1500		1.3	U	8.1	J	2.3	J
1,3,5-Trichlorobenzene	108-70-3	mg/kg	0.15	J	0.33	U	0.33	U	0.28		0.55	
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg	9.3	+	22		0.33	U	5.1	+	17	+
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg	12	+	11		0.33	U	0.62		2.1	
Pentachlorobenzene	608-93-5	mg/kg	0.54		0.55	J	0.33	U	0.85		4.2	+J
Hexachlorobenzene	118-74-1	mg/kg	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U

Note - A blank concentration value indicates that the compound was not detected.

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

D, + - Result from Diluted Sample

B - Contaminant Present in Blank

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SAMPLE NAME			MCET01_012803		MCET02_012703		MCET03_012803		MCET04_013003		MCET05_012903		MCET06_012703		MCET07_012803		MCET08_012803	
CLP SAMPLE NAME			C0ER0		C0EP8		C0EQ3		C0ET1		C0ER6		C0EP9		C0EQ5		C0EQ2	
Sample Date			28-Jan-03		27-Jan-03		28-Jan-03		30-Jan-03		29-Jan-03		27-Jan-03		28-Jan-03		28-Jan-03	
Northing			584715.00		584227.21		583987.45		583582.35		584289.39		584260.45		584056.60		583980.50	
Easting			593887.32		594155.42		594117.15		593813.80		594115.75		594243.89		594166.06		594035.13	
Preliminary Total COCs			56222.6		21.1		13.45		5.55		207		1374.4		134.6		406.95	
1,4-Dichlorobenzene	106-46-7	mg/kg	56000		4		1.4	N	4		37		1200		28	VS	250	
Benzene	71-43-2	mg/kg	7000	U	1.1	N	4.2		3.4	U	10		150	U	13	VS	43	U
Nitrobenzene	98-95-3	mg/kg	0.89	U	0.52	U	0.7	U	0.87	U	2.2	U	0.77	U	0.75	U	1.1	U
Toluene	108-88-3	mg/kg	7000	U	2.1	U	2.8	U	3.4	U	8.7	U	150	U	12	U	43	U
Chlorobenzene	108-90-7	mg/kg	220	N	16		7.6		0.74	N	150		42	N	77	VS	85	
1,2-Dichlorobenzene	95-50-1	mg/kg	7000	U	2.1	U	2.8	U	3.4	U	3.8	N	21	N	6.6	VS	5.8	N
1,3-Dichlorobenzene	541-73-1	mg/kg	7000	U	2.1	U	2.8	U	0.17	N	3.8	N	150	U	4.1	VS	4.8	N
1,2,3-Trichlorobenzene	87-61-6	mg/kg	2.6	JN									1.4	JN				
1,2,4-Trichlorobenzene	120-82-1	mg/kg	7000	U	2.1	U	0.25	N	0.64	N	2.4	N	110	N	5.9	VS	61	
1,3,5-Trichlorobenzene	108-70-3	mg/kg																
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg															0.35	JN
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg																
Pentachlorobenzene	608-93-5	mg/kg																
Hexachlorobenzene	118-74-1	mg/kg	0.89	U	0.52	U	0.7	U	0.87	U	2.2	U	0.77	U	0.75	U	1.1	U

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

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Table 4**

SAMPLE NAME			MCET09_013003		MCET10_012903		MCET11_013003		MCET12_012903		MCET13_012903		MCET14_012803		MCET15_013003		MCET16_012903	
CLP SAMPLE NAME			C0ES5		C0ER3		C0ES9		C0ER2		C0ER5		C0EQ4		C0ET0		C0ER7	
Sample Date			30-Jan-03		29-Jan-03		30-Jan-03		29-Jan-03		29-Jan-03		28-Jan-03		30-Jan-03		29-Jan-03	
Northing			584635.32		584543.87		584624.21		584534.02		584454.66		584161.45		583480.64		584682.06	
Easting			594399.69		594495.29		594127.33		594495.34		594367.70		594129.47		593820.83		593861.21	
Preliminary Total COCs			3839		70.77		584		90.4		224.451		17.55		0.139		109.2	
1,4-Dichlorobenzene	106-46-7	mg/kg	3400		23	VS	540		14	VS	63		1.8	N	0.11		29	VS
Benzene	71-43-2	mg/kg	270	U	2.6	VS	57	U	5.6	VS	6	N	5.5		0.022	U	1.3	VS
Nitrobenzene	98-95-3	mg/kg	14	U	0.67	U	0.72	U	0.89	U	0.051	N	0.89	U	0.73	U	0.89	U
Toluene	108-88-3	mg/kg	270	U	2.7	U	57	U	3.5	U	11	U	3.5	U	0.022	U	3.5	U
Chlorobenzene	108-90-7	mg/kg	240	N	31	VS	44	N	54	VS	110		9.9		0.009	N	57	VS
1,2-Dichlorobenzene	95-50-1	mg/kg	270	U	0.88	VS	57	U	10	VS	23		3.5	U	0.007	N	2.6	VS
1,3-Dichlorobenzene	541-73-1	mg/kg	270	U	0.59	VS	57	U	2.3	VS	10	N	3.5	U	0.005	N	1.2	VS
1,2,3-Trichlorobenzene	87-61-6	mg/kg	59	JN	1.7	JN											4.1	JN
1,2,4-Trichlorobenzene	120-82-1	mg/kg	140	N	11	VS	57	U	4.5	VS	11		0.35	N	0.008	N	14	VS
1,3,5-Trichlorobenzene	108-70-3	mg/kg									1.4	JN						
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg																
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg																
Pentachlorobenzene	608-93-5	mg/kg																
Hexachlorobenzene	118-74-1	mg/kg	14	U	0.67	U	0.72	U	0.89	U	0.56	U	0.89	U	0.73	U	0.89	U

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

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Table 4**

SAMPLE NAME			MCET17_012803		MCET18_013003		MCET19_013003		MCET20_012703		MCSD01_010603		MCSD02_010603		MCSD03_010603	
CLP SAMPLE NAME			C0EQ9		C0ES6		C0ES7		C0EQ0		C0EL2		C0EL5		C0EM2	
Sample Date			28-Jan-03		30-Jan-03		30-Jan-03		27-Jan-03		06-Jan-03		06-Jan-03		06-Jan-03	
Northing			584466.95		584424.76		584329.58		584735.11		584711.49		584660.28		584394.14	
Easting			594187.13		594289.07		594289.51		593270.20		593839.09		593836.70		594196.99	
Preliminary Total COCs			2562		93.02		7094.2		0		23.7		0.082		13886	
1,4-Dichlorobenzene	106-46-7	mg/kg	2100		73		2600				1.7	B	0.007	M	13000	B
Benzene	71-43-2	mg/kg	310	U	11	U	160	N			2.3	U	0.014	M	960	U
Nitrobenzene	98-95-3	mg/kg	0.79	U	0.7	U	1.5	U			0.66	U	0.46	U	33	VS
Toluene	108-88-3	mg/kg	310	U	11	U	300	U			2.3	U	0.014	M	960	U
Chlorobenzene	108-90-7	mg/kg	340		12		2300				22		0.005	M	320	J
1,2-Dichlorobenzene	95-50-1	mg/kg	28	N	3	N	530				2.3	U	0.014	M	960	U
1,3-Dichlorobenzene	541-73-1	mg/kg	20	N	0.92	N	200	N			2.3	U	0.014	M	960	U
1,2,3-Trichlorobenzene	87-61-6	mg/kg	4	JN			4.2	JN								
1,2,4-Trichlorobenzene	120-82-1	mg/kg	70	N	4.1	N	1300				2.3	U	0.014	M	500	J
1,3,5-Trichlorobenzene	108-70-3	mg/kg														
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg														
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg														
Pentachlorobenzene	608-93-5	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg	0.79	U	0.7	U	1.5	U			0.66	U	0.46	U	33	VS

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

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Table 4**

SAMPLE NAME			MCSD04_010603		MCSD05_010203		MCSD06_010203		MCSD07_010603		MCSD08_010603		MCSD09_121302 *		MCSD10_121302	
CLP SAMPLE NAME			C0EL0		C0EK8		C0EK6		C0EL1		C0EL4		C0EF6		C0EF7	
Sample Date			06-Jan-03		02-Jan-03		02-Jan-03		06-Jan-03		06-Jan-03		13-Dec-02		13-Dec-02	
Northing			584649.70		584631.43		584616.46		584692.69		584697.05		584458.78		584409.12	
Easting			593961.14		594356.66		594326.71		593889.39		593909.39		594123.17		594101.41	
Preliminary Total COCs			13855		398.5		3055		1298.2		30.38		1290325.97		17688.1	
1,4-Dichlorobenzene	106-46-7	mg/kg	12000	EB	73		2800		960		16		1100000		17000	
Benzene	71-43-2	mg/kg	44	J	120		18	J	7.8	J	0.55	J	310000	U	1500	U
Nitrobenzene	98-95-3	mg/kg	0.79	U	1.1	U	0.89	U	0.73	U	0.94	U	8.4	U	1.6	U
Toluene	108-88-3	mg/kg	57	U	16	U	160	U	52	U	3.4	U	310000	U	1500	U
Chlorobenzene	108-90-7	mg/kg	800		160		210		300		10		310000	U	1500	U
1,2-Dichlorobenzene	95-50-1	mg/kg	75		5.1	J	160	U	11	J	1.2	J	310000	U	1500	U
1,3-Dichlorobenzene	541-73-1	mg/kg	96		6.4	J	160	U	12	J	0.73	J	310000	U	1500	U
1,2,3-Trichlorobenzene	87-61-6	mg/kg											9900	JN		
1,2,4-Trichlorobenzene	120-82-1	mg/kg	840		34		27	J	7.4	J	1.9	J	180000	J	670	J
1,3,5-Trichlorobenzene	108-70-3	mg/kg											190	JN		
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg														
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg											180	JN		
Pentachlorobenzene	608-93-5	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg	0.79	U	1.1	U	0.89	U	0.73	U	0.94	U	0.97	J	1.1	J

*Note that the reported concentration exceeds 100% (>1,000,000 ppm) for 1,4-Dichlorobenzene.

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

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Table 4**

SAMPLE NAME			MCSD11_121102		MCSD12_010603		MCSD13_121102		MCSD14_121002		MCSD15_121002		MCSD16_121002		MCSD17_121002	
CLP SAMPLE NAME			C0ED7		C0EM4		C0ED5		C0EC3		C0EC6		C0EC9		C0ED2	
Sample Date			11-Dec-02		06-Jan-03		11-Dec-02		10-Dec-02		10-Dec-02		10-Dec-02		10-Dec-02	
Northing			584269.40		584667.44		584289.39		584184.70		584128.15		584072.41		583996.93	
Easting			594051.84		594390.68		594115.75		594046.00		594024.60		594037.99		594038.34	
Preliminary Total COCs			1.29		38.49		100.8		1.7		0.235		123.8		143.31	
1,4-Dichlorobenzene	106-46-7	mg/kg	0.38	J	3.1	B	100		2.4	U	0.047		5.4	J	56	
Benzene	71-43-2	mg/kg	0.06	U	0.57	J	7.3	U	2.4	U	0.007	J	3.7	J	9.2	
Nitrobenzene	98-95-3	mg/kg	0.39	VS	0.79	U	0.4	VS	0.64	U	0.49	U	1.3	U	0.41	U
Toluene	108-88-3	mg/kg	0.06	U	2.8	U	7.3	U	2.4	U	0.015	U	9.2	U	3	U
Chlorobenzene	108-90-7	mg/kg	0.13		34		7.3	U	1.7	J	0.11		110		25	
1,2-Dichlorobenzene	95-50-1	mg/kg	0.06	U	0.52	J	7.3	U	2.4	U	0.012	J	9.2	U	6.1	
1,3-Dichlorobenzene	541-73-1	mg/kg	0.06	U	0.3	J	7.3	U	2.4	U	0.004	J	9.2	U	2.8	J
1,2,3-Trichlorobenzene	87-61-6	mg/kg													3.2	JN
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.06	U	2.8	U	7.3	U	2.4	U	0.027		4.7	J	37	
1,3,5-Trichlorobenzene	108-70-3	mg/kg													3.2	JN
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg														
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg														
Pentachlorobenzene	608-93-5	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg	0.39	VS	0.79	U	0.4	VS	0.64	U	0.028	J	1.3	U	0.41	U

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

**Standard Chlorine of Delaware
Design Comparison Report
Table 4**

SAMPLE NAME			MCSD18_121002		MCSD19_121002		MCSD20_121002		MCSD21_121002		MCSD22_120902		MCSD23_121002		MCSD24_120902		MCSD25_120902	
CLP SAMPLE NAME			C0ED3		C0EC8		C0EC7		C0ED4		C0EB5		C0ED0		C0EB6		C0EB7	
Sample Date			10-Dec-02		10-Dec-02		10-Dec-02		10-Dec-02		09-Dec-02		10-Dec-02		09-Dec-02		09-Dec-02	
Northing			583954.06		584227.21		584230.28		584275.18		584108.68		584062.17		584118.79		584079.10	
Easting			593995.87		594155.42		594179.04		594236.92		594073.92		593952.70		594129.34		594064.21	
Preliminary Total COCs			0.003		23.2		155.6		148.3		0.892		1.224		4.46		37.913	
1,4-Dichlorobenzene	106-46-7	mg/kg	0.003	B	3.1		45		3.8	J	0.042		0.16		0.2	J	35	
Benzene	71-43-2	mg/kg	0.012	U	0.84	J	2	J	34		0.25		0.11	U	0.023	J	18	U
Nitrobenzene	98-95-3	mg/kg	0.39	U	0.46	U	4.7	U	3	VS	0.51	U	0.72	U	0.71	U	0.49	U
Toluene	108-88-3	mg/kg	0.012	U	1.8	U	3.6	U	22	U	0.016	U	0.11	U	0.22	U	18	U
Chlorobenzene	108-90-7	mg/kg	0.012	U	16		28		92		0.58		1		1.4		2.2	J
1,2-Dichlorobenzene	95-50-1	mg/kg	0.012	U	0.26	J	4.6		22	U	0.005	J	0.014	J	0.22	U	18	U
1,3-Dichlorobenzene	541-73-1	mg/kg	0.012	U	1.8	U	1.4	J	22	U	0.01	J	0.05	J	0.053	J	18	U
1,2,3-Trichlorobenzene	87-61-6	mg/kg																
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.012	U	3		39		22	U	0.005	J	0.11	U	0.22	U	18	U
1,3,5-Trichlorobenzene	108-70-3	mg/kg							6.6	JN					1	JN		
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg																
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg					1.2	JN	2.8	JN					0.84	JN		
Pentachlorobenzene	608-93-5	mg/kg																
Hexachlorobenzene	118-74-1	mg/kg	0.39	U	0.46	U	1.4	J	3	VS	0.51	U	0.72	U	0.084	J	0.073	

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

**Standard Chlorine of Delaware
Design Comparison Report
Table 4**

SAMPLE NAME			MCSD26_120902		MCSD27_121002		MCSD28_120902		MCSD29_120902		MCSD30_120902		MCSD31_121302		MCSD32_121302		MCSD33_121202	
CLP SAMPLE NAME			C0EB8		C0ED1		C0EC2		C0EC1		C0EB9		C0EF3		C0EF1		C0EE7	
Sample Date			09-Dec-02		10-Dec-02		09-Dec-02		09-Dec-02		09-Dec-02		13-Dec-02		13-Dec-02		12-Dec-02	
Northing			584027.90		584085.21		583980.50		583914.92		583979.52		583789.71		583746.96		583559.16	
Easting			594134.36		593965.72		594035.13		594048.56		594105.37		593940.84		593924.62		593767.96	
Preliminary Total COCs			186		0.979		220.62		3.031		113.859		5.65		26.3		1.027	
1,4-Dichlorobenzene	106-46-7	mg/kg	83	J	0.11		150		0.38		1.8	J	1.9	J	2.3		0.007	B
Benzene	71-43-2	mg/kg	39	UJ	0.089	U	4.5	J	0.022	J	57	J	2.2	U	9		0.016	U
Nitrobenzene	98-95-3	mg/kg	1	VS	0.57	U	0.49	U	0.72	U	1.2	U	0.6	U	0.55	U	0.51	VS
Toluene	108-88-3	mg/kg	39	UJ	0.089	U	18	U	0.039	J	0.039	J	2.2	U	2	U	0.016	U
Chlorobenzene	108-90-7	mg/kg	60	J	0.83		46		2.3		54	J	2.2	U	15		0.016	U
1,2-Dichlorobenzene	95-50-1	mg/kg	28	J	0.089	U	3.6	J	0.07	J	0.56	J	0.33	J	2	U	0.016	U
1,3-Dichlorobenzene	541-73-1	mg/kg	13	J	0.039	J	18	U	0.11	J	0.34	J	0.45	J	2	U	0.016	U
1,2,3-Trichlorobenzene	87-61-6	mg/kg					1.1	JN					2.4	JN				
1,2,4-Trichlorobenzene	120-82-1	mg/kg	39	UJ	0.089	U	18	U	0.11	J	0.12	J	0.57	B	2	U	0.016	U
1,3,5-Trichlorobenzene	108-70-3	mg/kg																
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg					10	JN										
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg																
Pentachlorobenzene	608-93-5	mg/kg																
Hexachlorobenzene	118-74-1	mg/kg	1	VS	0.57	U	0.22	J	0.72	U	1.2	U	0.6	U	0.55	U	0.51	VS

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

**Standard Chlorine of Delaware
Design Comparison Report
Table 4**

SAMPLE NAME			MCSD34_121202		MCSD35_121202		MCSD36_121302		MCSD37_121302		MCSD38_121202		MCSD39_121202		MCSD40_121202		MCSD41_121202	
CLP SAMPLE NAME			C0EE8		C0EE4		C0EF5		C0EF2		C0EE6		C0EE3		C0EE1		C0EE0	
Sample Date			12-Dec-02		12-Dec-02		13-Dec-02		13-Dec-02		12-Dec-02		12-Dec-02		12-Dec-02		12-Dec-02	
Northing			583615.09		583582.35		583799.58		583526.14		583568.81		583526.19		583424.05		584089.36	
Easting			593797.24		593813.80		593947.35		593725.44		593725.24		593735.29		593650.43		594152.78	
Preliminary Total COCs			0.032		1.208		102.414		0.118		1.108		1.638		0.968		1.77	
1,4-Dichlorobenzene	106-46-7	mg/kg	0.02	B	0.006	B	3.9		0.039	M	0.006	B	0.018	B	0.006	B	0.063	J
Benzene	71-43-2	mg/kg	0.021	U	0.019	U	61		0.02	M	0.017	U	0.025	U	0.015	U	0.013	J
Nitrobenzene	98-95-3	mg/kg	0.68	U	0.6	VS	0.46	U	0.52	U	0.55	VS	0.81	VS	0.48	VS	0.52	VS
Toluene	108-88-3	mg/kg	0.021	U	0.019	U	1.3	U	0.02	M	0.002	B	0.025	U	0.002	B	0.078	U
Chlorobenzene	108-90-7	mg/kg	0.021	U	0.019	U	34		0.02	M	0.017	U	0.025	U	0.015	U	0.64	
1,2-Dichlorobenzene	95-50-1	mg/kg	0.006	J	0.019	U	0.52	J	0.007	M	0.017	U	0.025	U	0.015	U	0.078	U
1,3-Dichlorobenzene	541-73-1	mg/kg	0.006	J	0.002	J	0.7	J	0.009	M	0.017	U	0.025	U	0.015	U	0.014	J
1,2,3-Trichlorobenzene	87-61-6	mg/kg																
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.021	U	0.019	U	1.1	J	0.003	M	0.017	U	0.025	U	0.015	U	0.078	U
1,3,5-Trichlorobenzene	108-70-3	mg/kg																
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg																
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg					0.66	JN										
Pentachlorobenzene	608-93-5	mg/kg																
Hexachlorobenzene	118-74-1	mg/kg	0.68	U	0.6	VS	0.044	J	0.52	U	0.55	VS	0.81	VS	0.48	VS	0.52	VS

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

**Standard Chlorine of Delaware
Design Comparison Report
Table 4**

SAMPLE NAME			MCSD42_121202		MCSD43_121202		MCSD45_010603		MCSD60_031003		MCSD61_031003		MCSD62_031003		MCSD63_031003		MCSD64_031003	
CLP SAMPLE NAME			C0EE2		C0EE5		C0EM3		C0EW4		C0EW6		C0EW7		C0EW8		C0EW9	
Sample Date			12-Dec-02		12-Dec-02		06-Jan-03		10-Mar-03		10-Mar-03		10-Mar-03		10-Mar-03		10-Mar-03	
Northing			583519.53		583506.28		584671.79		584580.34		584626.89		584648.94		584698.58		584678.14	
Easting			593715.63		593689.43		594266.92		594646.75		594562.84		594434.08		594381.01		594291.18	
Preliminary Total COCs			1.276		1.253		154.1		904.3		46.962		35.146		81.011		2134.78	
1,4-Dichlorobenzene	106-46-7	mg/kg	0.016	B	0.009	B	47		240		3.6		3.6		2.7	N	570	
Benzene	71-43-2	mg/kg	0.019	U	0.019	U	7.4		84		0.5	N	0.4	N	0.73	N	59	U
Nitrobenzene	98-95-3	mg/kg	0.63	VS	0.62	VS	0.63	U	0.29	N	0.62	U	0.58	U	0.72	U	0.7	
Toluene	108-88-3	mg/kg	0.019	U	0.004	B	5.8	U	25	U	2.5	U	2.3	U	2.8	U	59	U
Chlorobenzene	108-90-7	mg/kg	0.019	U	0.019	U	79		400		40		29		77		190	
1,2-Dichlorobenzene	95-50-1	mg/kg	0.019	U	0.019	U	7.5		130		1.1	N	2.3	U	2.8	U	63	
1,3-Dichlorobenzene	541-73-1	mg/kg	0.019	U	0.019	U	7.5		41		1.3	N	1.1	N	0.49	N	46	N
1,2,3-Trichlorobenzene	87-61-6	mg/kg							3.5	NJ							160	NJD
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.019	U	0.019	U	5.7	J	4.9	N	0.39	N	2.3	U	2.8	U	920	
1,3,5-Trichlorobenzene	108-70-3	mg/kg																
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg																
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg																
Pentachlorobenzene	608-93-5	mg/kg							0.68	U	0.62	U	0.49	N	0.72	U	13	
Hexachlorobenzene	118-74-1	mg/kg	0.63	VS	0.62	VS	0.63	U	0.68	U	0.62	U	0.58	U	0.72	U	0.28	N

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

**Standard Chlorine of Delaware
Design Comparison Report
Table 4**

SAMPLE NAME			MCSD65_031003		MCSD66_031003		MCSD67_031003		MCSD68_031003		MCSD69_031003		MCSD70_050803		MCSD71_050803		MCSD72_050803	
CLP SAMPLE NAME			C0EX5		C0EX3		C0EX0		C0EX1		C0EX2		C0F61		C0F62		C0F63	
Sample Date			10-Mar-03		10-Mar-03		10-Mar-03		10-Mar-03		10-Mar-03		05-May-03		05-May-03		05-May-03	
Northing			584680.98		584672.23		584690.23		584676.09		584724.53		584607.11		584642.80		584668.51	
Easting			594265.57		594218.35		594136.87		593990.55		593890.23		594685.36		594596.58		594478.30	
Preliminary Total COCs			527.79		53		33.37		31.476		204.77		1978.49		50.79		58.3	
1,4-Dichlorobenzene	106-46-7	mg/kg	240		5		7.4		4.1		39		680		3.3		2.3	J
Benzene	71-43-2	mg/kg	24		2	N	0.38	N	2.3	N	1.1	N	34	J	0.98	J	4.2	U
Nitrobenzene	98-95-3	mg/kg	0.76	U	0.68	U	0.61	U	0.62	U	0.63	U	0.49	J	0.66	U	0.29	U
Toluene	108-88-3	mg/kg	24	U	2.9	U	2.3	U	2.9	U	5.4	U	62	U	2.5	U	4.2	U
Chlorobenzene	108-90-7	mg/kg	110		40		19		22		120		320		45		56	
1,2-Dichlorobenzene	95-50-1	mg/kg	33		0.28	N	0.9	N	2.9	U	6.1		750		0.52	J	4.2	U
1,3-Dichlorobenzene	541-73-1	mg/kg	25		0.34	N	2.7		0.82	N	8.7		110		0.99	J	4.2	U
1,2,3-Trichlorobenzene	87-61-6	mg/kg	4.7	NJ							12	NJ						
1,2,4-Trichlorobenzene	120-82-1	mg/kg	84		2.9	U	1.7	N	1	N	3.2	N	84		2.5	U	4.2	U
1,3,5-Trichlorobenzene	108-70-3	mg/kg					0.37	NJ										
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg																
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg																
Pentachlorobenzene	608-93-5	mg/kg	2.6		2.2		0.13	N	0.48	N	2.2							
Hexachlorobenzene	118-74-1	mg/kg	0.76	U	0.68	U	0.61	U	0.62	U	0.63	U	0.078	U	0.66	U	0.29	U

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

**Standard Chlorine of Delaware
Design Comparison Report
Table 4**

SAMPLE NAME			MCSD73_050803		MCSD74_050803		MCSD75_050803		MCSD76_050803		MCSD77_050803		MCSD78_050803		MCSD79_050803	
CLP SAMPLE NAME			C0F64		C0F66		C0F67		C0F68		C0F69		C0F70		C0F71	
Sample Date			05-May-03		05-May-03		05-May-03		05-May-03		05-May-03		05-May-03		05-May-03	
Northing			584725.60		584684.35		584703.74		584726.37		584729.37		584728.95		584771.70	
Easting			594424.40		594356.79		594291.06		594222.03		594156.38		594064.48		593885.50	
Preliminary Total COCs			1280.32		16.4		13091.3		30.01		389.64		217.6		8.35	
1,4-Dichlorobenzene	106-46-7	mg/kg	520		1.2	J	4000		1.1	J	8.5	J	99		2.1	J
Benzene	71-43-2	mg/kg	25	U	2.2		880	U	1.5	J	37		8.3	U	2.4	U
Nitrobenzene	98-95-3	mg/kg	0.33	U	0.56	U	0.31	UJ	0.56	U	0.67	U	0.51	U	0.58	U
Toluene	108-88-3	mg/kg	25	U	2.1	U	880	U	2	U	26	U	8.3	U	2.4	U
Chlorobenzene	108-90-7	mg/kg	230		13		720	J	27		340		55		4.5	
1,2-Dichlorobenzene	95-50-1	mg/kg	43		2.1	U	730	J	2	U	26	U	12		0.32	J
1,3-Dichlorobenzene	541-73-1	mg/kg	77		0.33	J	240	J	2	U	2.8	J	14		0.43	J
1,2,3-Trichlorobenzene	87-61-6	mg/kg														
1,2,4-Trichlorobenzene	120-82-1	mg/kg	410		2.1	U	7400		0.35	J	26	U	21		1	J
1,3,5-Trichlorobenzene	108-70-3	mg/kg														
1,2,3,4-Tetrachlorobenzene	634-66-2	mg/kg														
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg														
Pentachlorobenzene	608-93-5	mg/kg														
Hexachlorobenzene	118-74-1	mg/kg	0.32	J	0.56	U	1.3		0.56	U	0.67	U	0.51	U	0.58	U

Note - Some of the above data are Preliminary.

U - Not Detected

J - Estimated Value

NJ, JN - Tentatively Identified Compound (TIC)

+, D - Result from Diluted Sample

B - Contaminant Present in Blank

Note - For compounds where the concentration field is blank, the compound was not detected.

Table 5 Soil Excavation Volume Estimates

Site	FS Report Estimates			Design Comparison Estimates		
	Area (sq ft)	Depth (ft)	Volume (cu yd) ^a	Area (sq ft)	Depth (ft)	Volume (cu yd) ^a
Railroad Track Area						
1981 Release Path	36,050	3	4,400	--	--	-- ^b
1986 Release Path	1,260	3	150	--	--	-- ^b
Western Drainage Gully						
Surface Soils	12,600	3	1,550	12,600	3	1,550
Subsurface Soils	6,300	3 - 7	1,000	6,300	3 - 7	1,000
Eastern Drainage Ditch	2,750	3 ^c	350	2,750	3 ^c	350
Soil Pile Area						
Soil Piles ^d	--	--	4,700	--	--	4,700
Underlying Soil	16,000	2	1,200	16,000	2	1,300
Runoff Area (Near RD Sample SS-10)	--	--	--	4,000	3	500
Sedimentation Basin	--	--	3,350	--	--	3,350
Tributary Wetlands						
Northern Portion of Tributary Wetlands	271,000	1	11,000	360,900	7	102,900
Confluence of Drainage Gully and Tributary	23,165	1	950	23,165	7	6,600
RI Sample SST-31 Area	700	1	25	700	7	200
RI Sample SD-4 Area	700	1	25	--	--	-- ^e
RD Sample SD-36-W Area	--	--	--	700	7	200
Catch Basin #1	6,000	15 ^c	3,700	6,000	15 ^c	3,650
TOTALS	370,225		32,400	426,815		126,300

Note - Unless specific RD data contradicts FS excavation area and volume estimates, the RI data will be used.

- a - Volume (cu yd) = 1.10 [Area (sq ft) x Depth (ft)] / 27 (cu ft/cu yd). 1.10 is a 10% overexcavation factor. Volumes are rounded to the nearest 50 cu yd.
- b - The ROD stipulates that this area will not be excavated (only covered with a low permeability asphalt cap). It is expected that because of the abandonment of the facility, this area will be excavated to some depth. Any such change would increase the total volume requiring excavation.
- c - Maximum depth of excavation as stipulated in the Site ROD. It is possible that this limitation will be removed because the Site has been abandoned.
- d - Soil Pile volumes provided by the PRP during the RI.
- e - Volume attributed to SD-4 Area in the FS Report has been incorporated into the expanded Northern Portion volume.

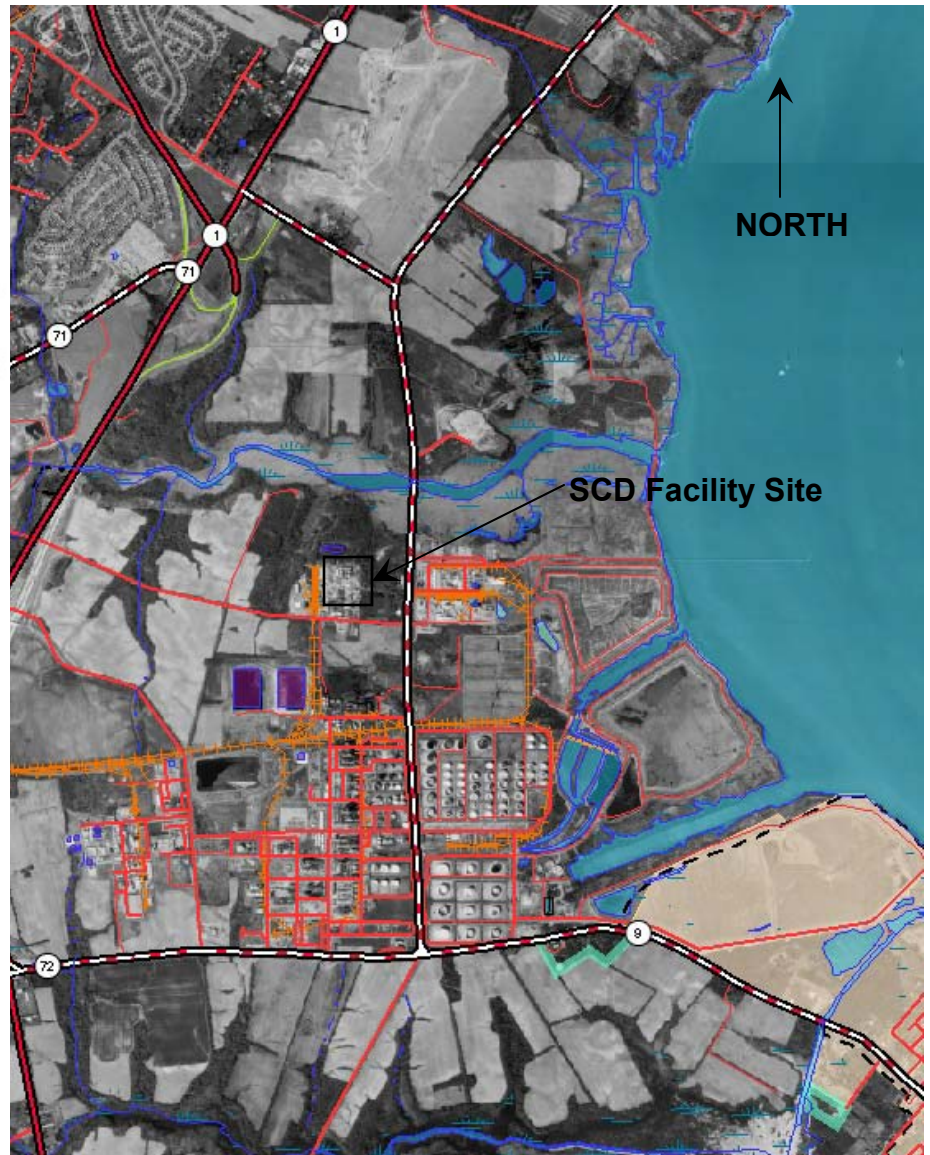
EPA Contract No.: 68-S7-3002
Work Assignment No.:038-RDRD-03H6
Black & Veatch Project No. 47118.128

Design Comparison Study
Revision: 0
June 13, 2003

FIGURES

DataMIL Legend

Boundary Monuments	Channel
Boundary Monument (NGS)	Covered Reservoir
Boundary Reference Monument (NGS)	Dam/Weir
State/County Lines	Flat or Shoal
Boundary Closure Line	Industrial Impoundment
County Boundary Line	Intermittent Water
State Boundary Line	Obstruction Area
Hydrography (lines)	Rapids
Stream, Shoreline, or Canal	Water Treatment Reservoir
Dam/Weir or Gate	Swamp/Marsh
Danger Curve	Swamp/Marsh (Submerged)
Falls	Municipal Boundaries
Reef (Rock)	Aerial Image
Manmade Shoreline	
Intermittent Stream/River	
Unsurveyed or Indefinite Stream/River	
USGS Roads	
Road, Class 1	
Road, Class 2	
USGS Railroads	
Railroad or Siding	
Railroad or Siding (Underpassing)	
Hydrography (areas)	
Open Water (Various Types)	



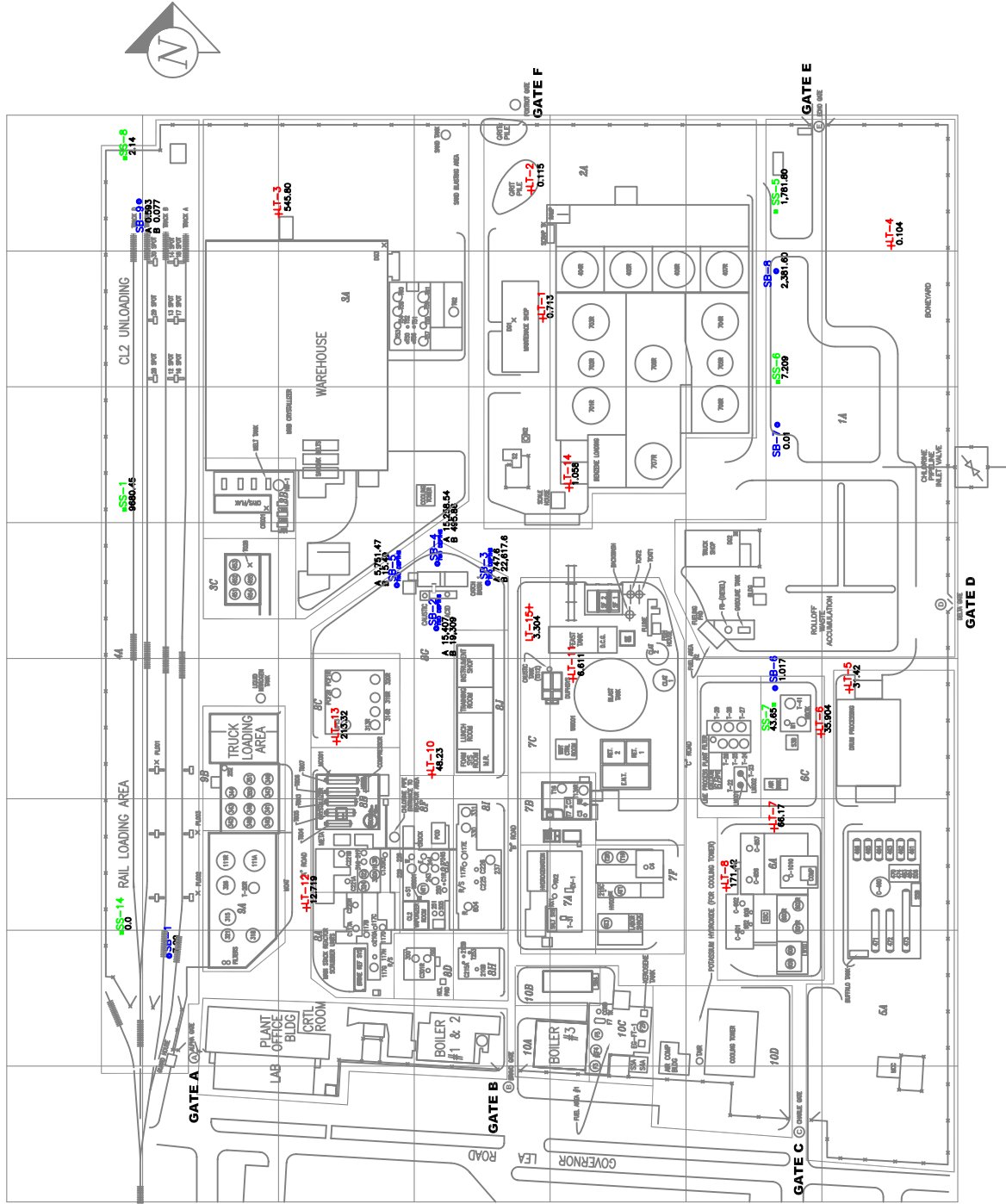
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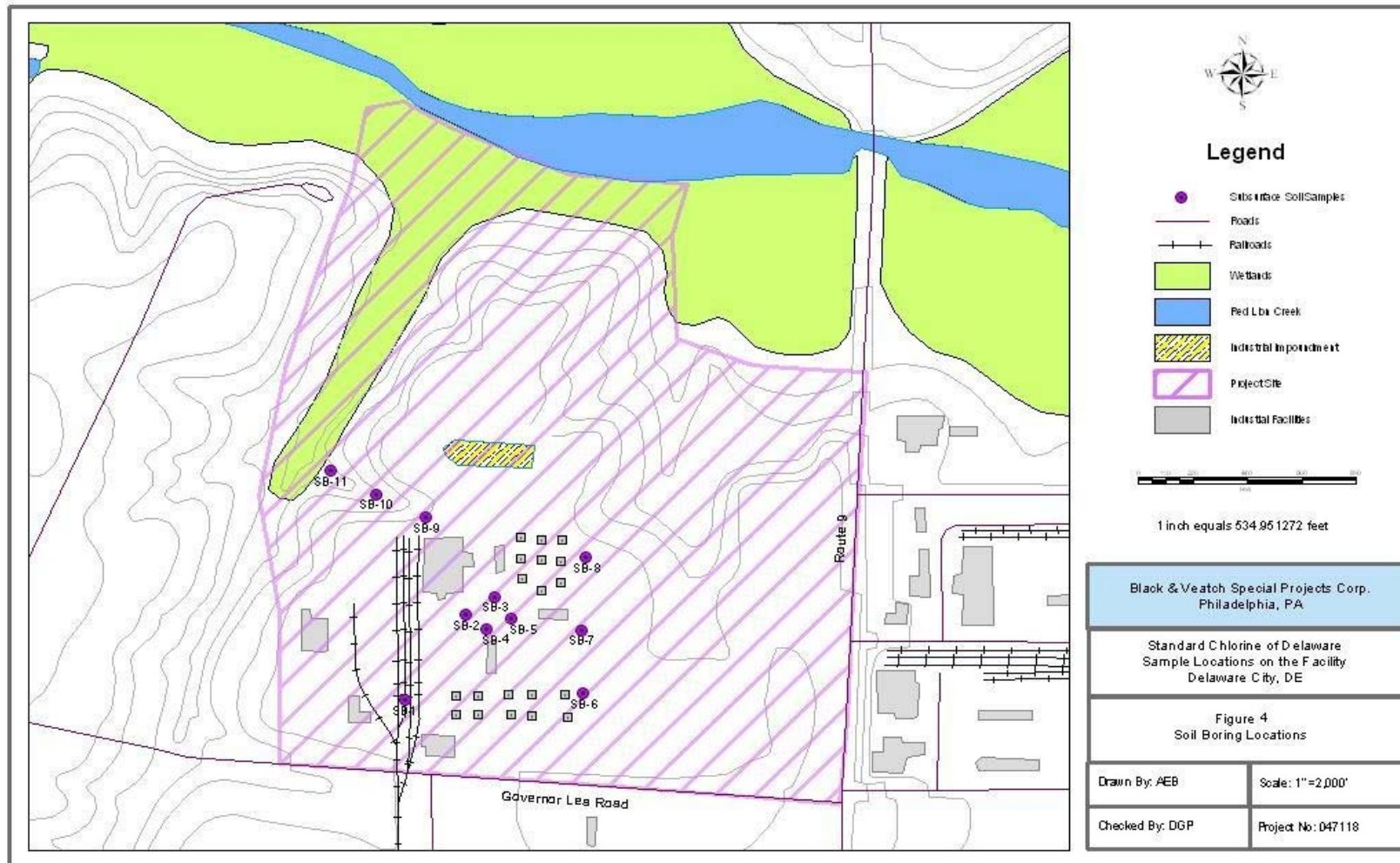
NOTE: ALL SAMPLE RESULTS ARE BASED ON VALIDATED DATA. SAMPLE CONCENTRATIONS ARE IN PARTS PER MILLION (ppm) EXCEPTING LT-4, LT-5 AND LT-10.

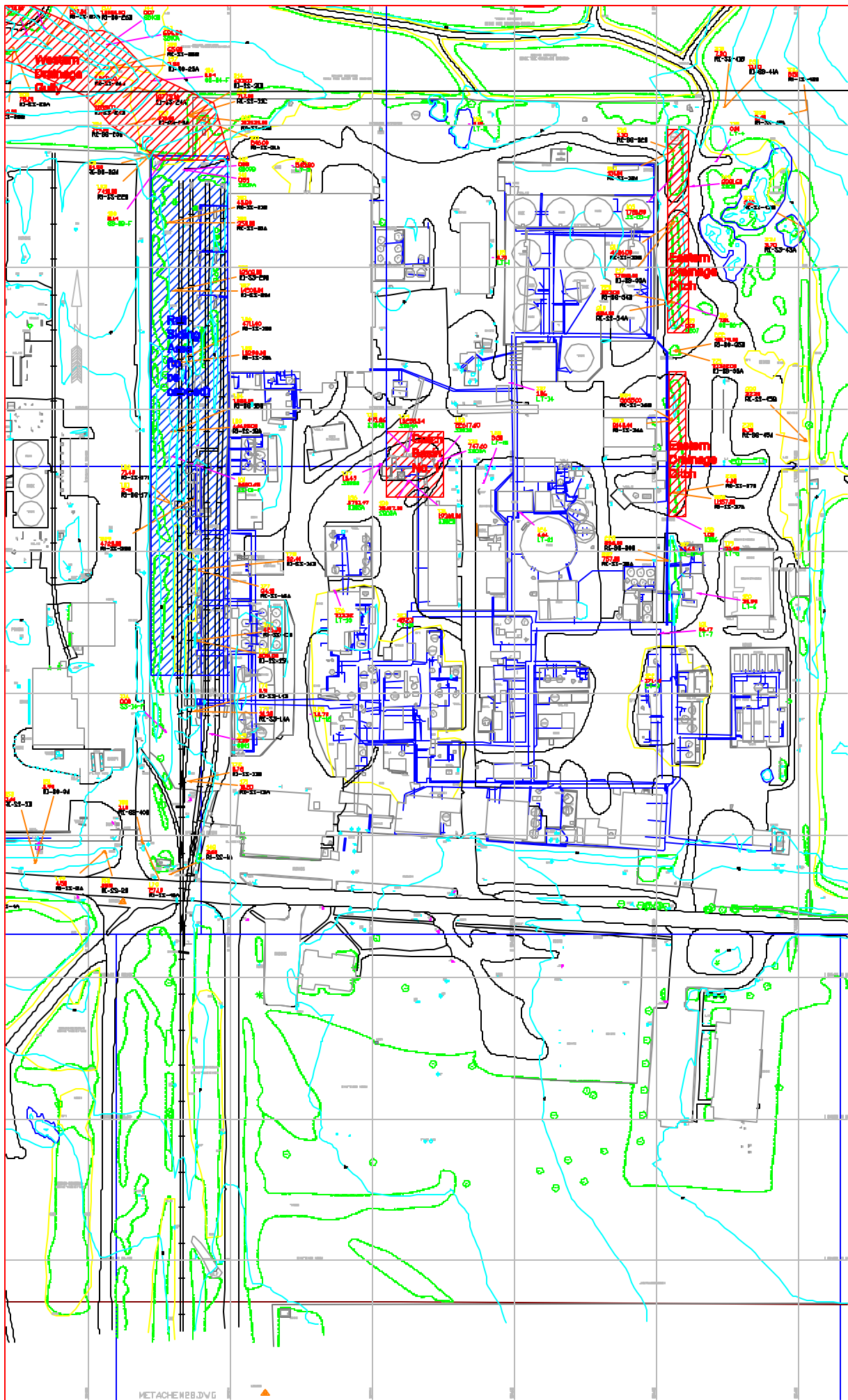
NOTE: NUMBERS BENEATH SAMPLING LOCATION IDENTIFIERS (E.G. LT-01, SS-06, ETC.) REPRESENT THE SUM OF THE TOTAL COCs AT THAT LOCATION IN ppm.

LOCATION IDENTIFIERS PRECEDED BY "SB" ARE SOIL BORING SAMPLING LOCATIONS. SUBSURFACE SAMPLES WERE TAKEN WITH A GEOPROBE. WHEN SAMPLES WERE TAKEN FROM MULTIPLE DEPTHS AT THE SAME LOCATION, THE TOTAL COC RESULT FOR THE SAMPLE TAKEN CLOSER TO THE SURFACE IS PRECEDED BY AN "A". THE RESULT FOR THE DEEPER SAMPLE IS PRECEDED BY "B".

"SS" AND "LT" LOCATION IDENTIFIERS INDICATE SURFACE SOIL SAMPLE LOCATIONS.

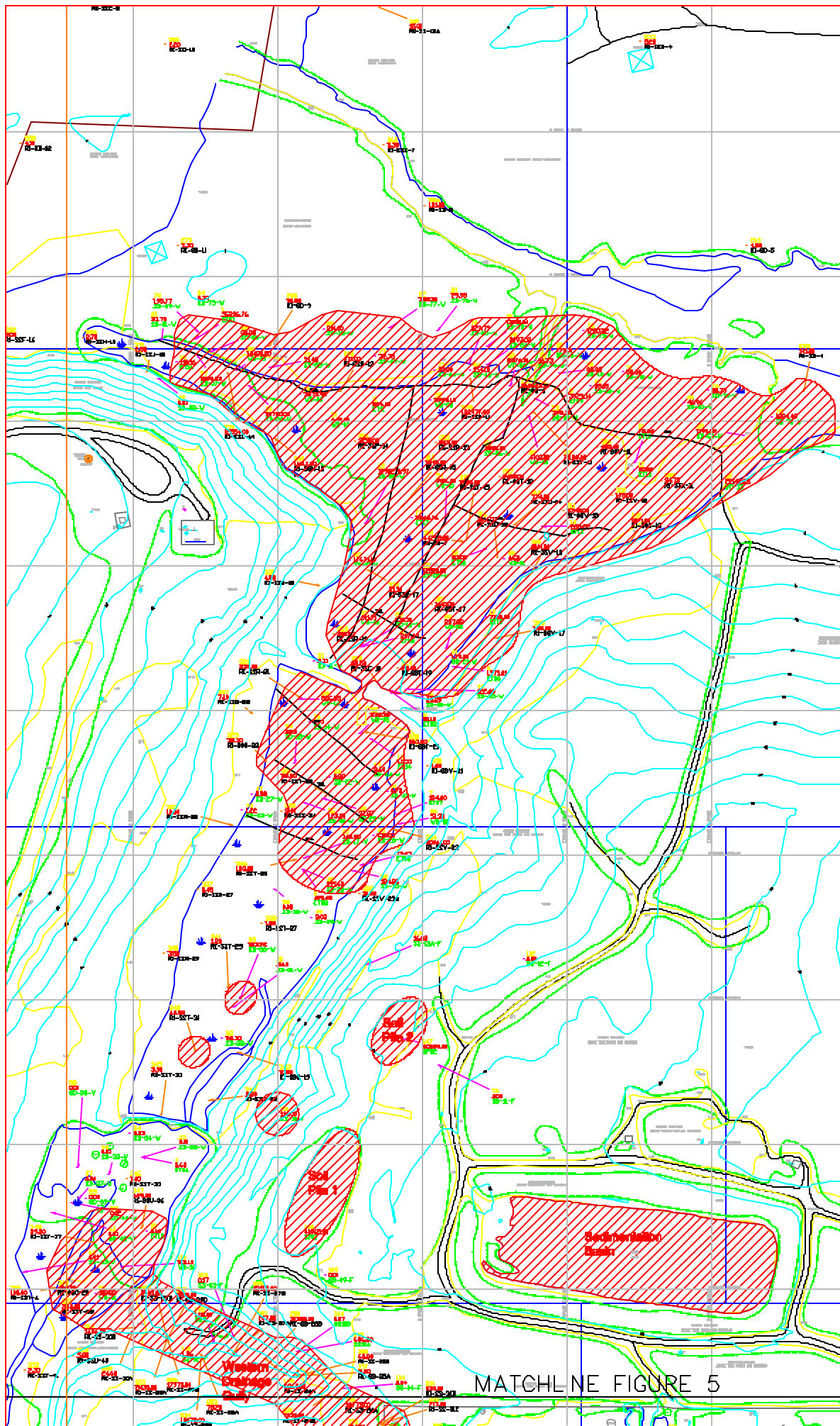




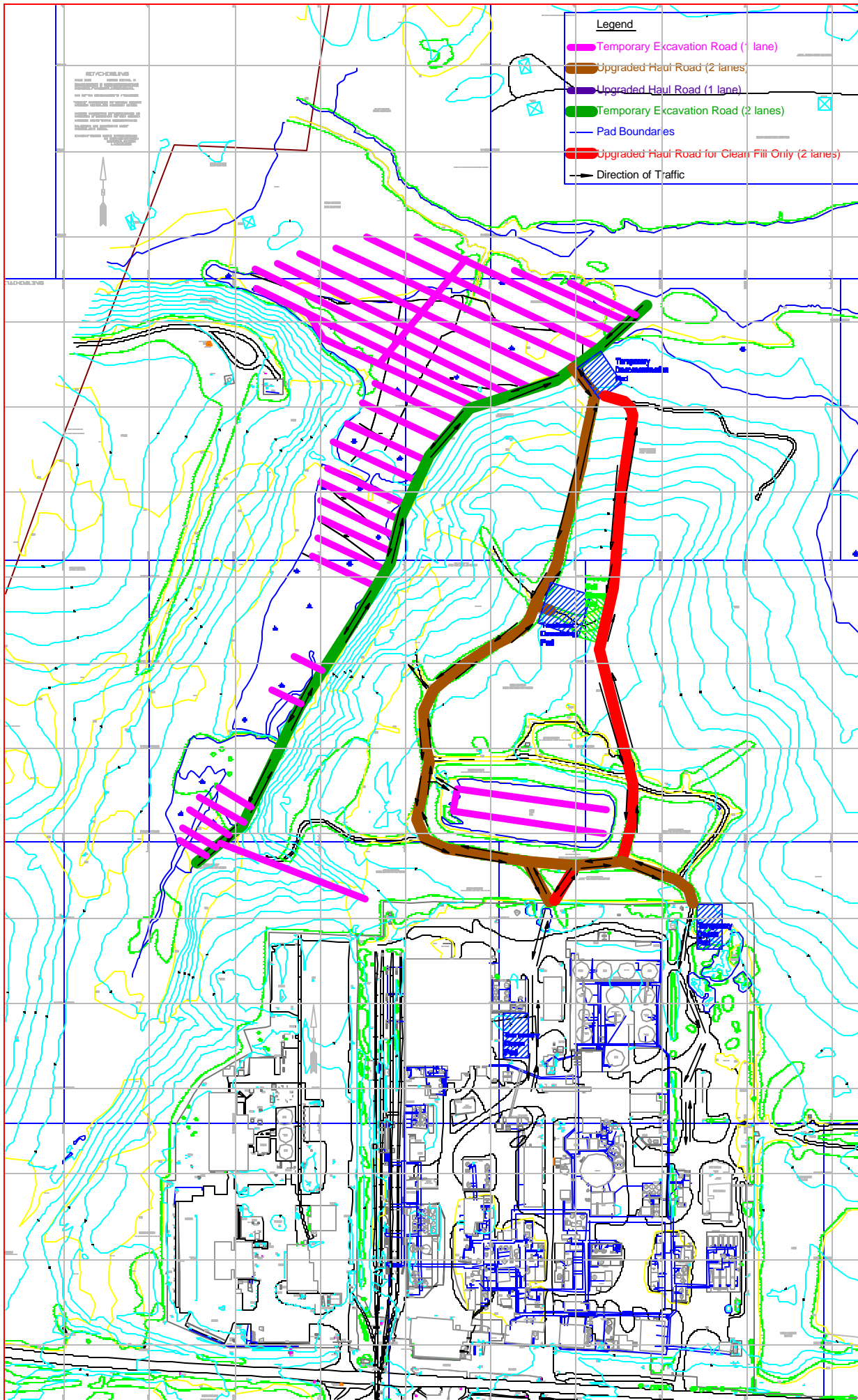


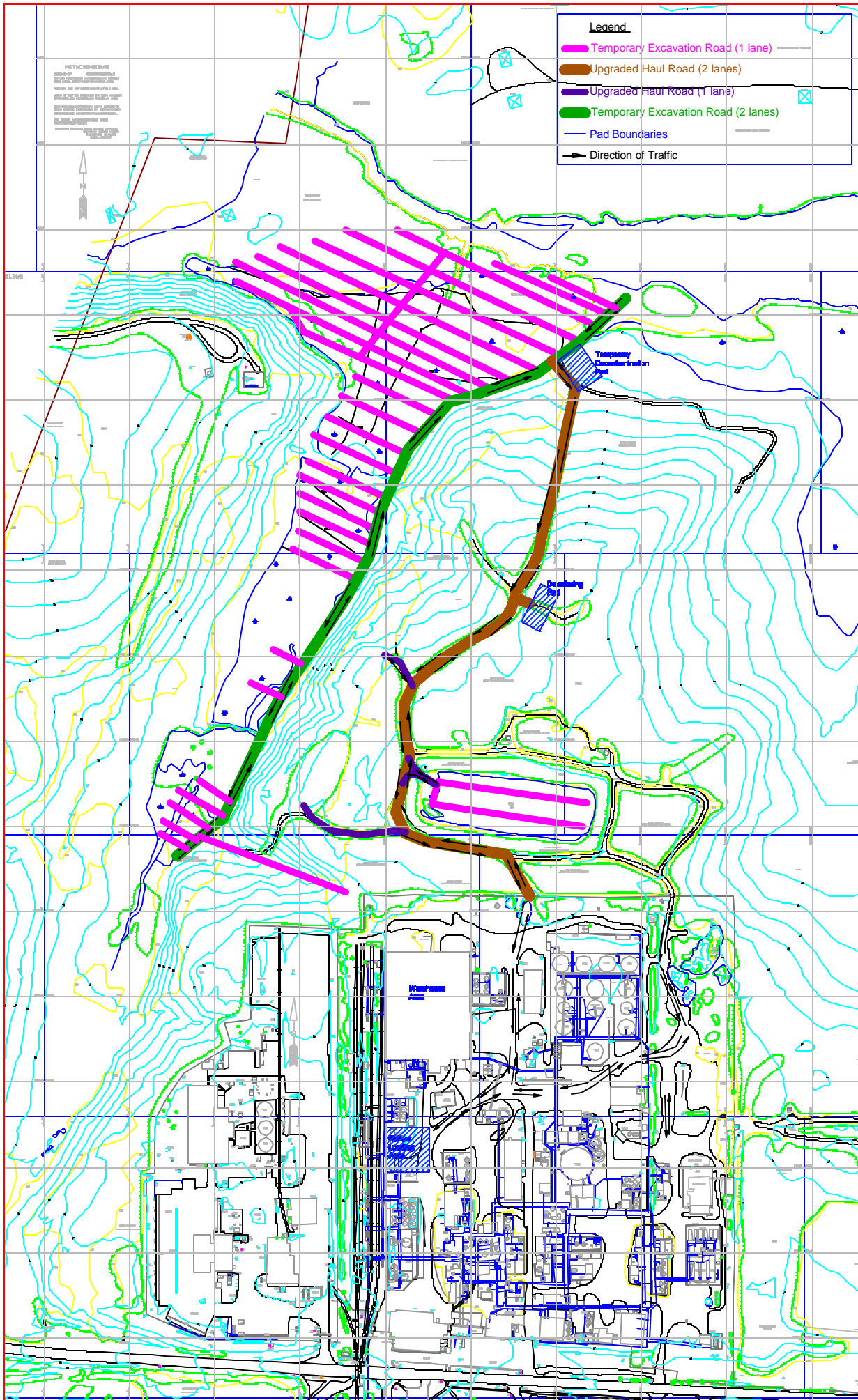
METACHEMBB.DWG

PROJECT NO.		5	
PROJECT NAME		STANDARD CHLORINE OF DELAWARE FACILITY EXCAVATION CAPPING EXTENTS U.S. ENVIRONMENTAL PROTECTION AGENCY REGION III	
PROJECT ID		047118	
PROJECT LOCATION		BALICE & VANCE Special Projects Corp.	
DATE		12/12/18	
DRAWN BY		J. B. B.	
CHECKED BY		J. B. B.	
APPROVED BY		J. B. B.	
SCALE		1" = 100'	
SHEET NO.		5	



 BLAKE & VEATCH <i>Special Projects Corp.</i>	PROJECT NO.	047118	PROJECT NAME	STANDARD CHLORINE OF DELAWARE NON-FACILITY EXCAVATION EXTENTS U.S. ENVIRONMENTAL PROTECTION AGENCY REGION III	DATE	12/27/00	SCALE	1" = 100'	FIGURE NO.	6
	<p>THIS MAP WAS PREPARED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION III, AND IS NOT TO BE USED FOR ANY OTHER PURPOSE WITHOUT THE WRITTEN PERMISSION OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION III.</p>									





EPA Contract No.: 68-S7-3002
Work Assignment No.:038-RDRD-03H6
Black & Veatch Project No. 47118.128

Design Comparison Study
Revision: 0
June 13, 2003

APPENDIX A

Excavation and Dewatering Methods

Before any excavation begins, a state-approved sediment and stormwater management plan will be put in place for the Site. In addition, no wetlands excavation activities will commence until a minimum of four person-days are spent collecting and relocating wildlife residing in that area.

In all cases, excavation will continue in an area until the minimum design depth and areal limits for that area are reached. For each area, these minimum limits have been established based on results from RD and previous sampling data as well as ROD-specified depth limits. Once the minimum excavation limits have been reached and no obvious signs of contamination are observed (e.g., staining, elevated PID readings), confirmation samples will be collected from the floor of the excavation and from the excavation limit sidewalls (i.e., in the wetlands no samples will be collected from sidewalls that will be excavated as part of excavation work in adjacent wetlands areas). In the Sedimentation Basin, these samples will be collected following the removal of all sediments and the basin liner unless obvious signs of residual contamination are present. In the area of the Soil Piles, the minimum excavation depth will be 2 ft bgs unless obvious signs of residual contamination are present.

The number and location of confirmation samples in each excavation area will be determined in accordance with a method (approved by the EPA and DNREC) designed to ensure statistical significance of the sampling event. These samples will be analyzed for COCs in an onsite mobile lab using the appropriate EPA analytical methods. Except in those areas where the ROD-specified depth limit has been reached (e.g., Catch Basin #1, Eastern Drainage Ditch, Western Drainage Gully), excavation will continue if the confirmation sampling results show contamination is still present at concentrations greater than the ROD-specified cleanup level for that area. If no COCs are detected in any confirmation sample (or if the analysis shows COC concentrations below the cleanup criteria), a second confirmation sample will be collected from the same location and sent to an EPA CLP laboratory for full Target Contaminant List (TCL) analysis with appropriate QA/QC.

Groundwater and other runoff resulting from excavation activities will be pumped to the existing facility wastewater treatment plant (WWTP) for treatment prior to discharge. In the event that the facility WWTP is not available (i.e., has already been deactivated/dismantled), the water will be treated using filtration and carbon adsorption before being discharged to the Red Lion Creek. If the facility's WWTP is available, discharge of the treated water would occur under the facility's existing National Pollutant Discharge Elimination System (NPDES) permit (possibly with some modification). Otherwise, a separate NPDES permit equivalency would be required to cover the new discharge.

Upland Excavation Areas

Materials from the Soil Pile, Western Drainage Gully, Eastern Drainage Ditch, Catch Basin #1, and Sedimentation Basin areas will be excavated using track or tire mounted backhoes. Accepted excavation practices will be employed to ensure worker safety and cost-effective completion of excavation activities. Silt fencing and other appropriate sedimentation/erosion control measures will be employed in accordance with ARARs. Excavation shoring will be employed as needed (particularly in the area of Catch Basin #1 and the Western Drainage Gully) to prevent collapse of the excavation and/or undermining of nearby structures.

Wetlands Excavation Areas

While the aforementioned areas will be addressed using standard excavation practices, a number of issues will need to be addressed before the removal of contaminated materials can begin in the wetlands areas.

- The integrity of the confining layer must not be compromised.
- Contamination must be contained so that the act of cleanup does not spread contamination to other areas.
- The stability of the hills on either side of the Western Drainage Gully must be preserved.
- It is desirable to limit the amount of ground water entering the contaminated area.
- When the cleanup is complete the existing groundwater flow characteristics must be restored to the extent possible.
- The cleanup must consider stormwater runoff which normally flows through the contaminated drainage area.

The Site is characterized as being primarily sands and gravels over a confining layer. Since the morphology is a stream bed, the sands and gravels are expected to contain organics and fine-grained soil in varying amounts.

The contamination plume to be remediated is also fairly well characterized. The size and shape of the plume are fairly well defined. Vertically the plume generally extends from the surface down to the Potomac confining layer. The material description of the confining layer creates some doubt about whether it truly functions as a confining layer. However, for the purpose of this study, it is assumed that the confining layer does resist vertical migration sufficiently that clean-up only needs to go at deepest to the top of that layer.

Several alternatives have been considered. One solution addresses all of the concerns discussed above and is presented here. This solution is shown in cross-section in Figure B-1.

The proposed excavation support forms a large 'bathtub' that contains the contaminated plume on the bottom and all sides. The primary purpose of total containment is to reduce the volume of ground water intrusion into the contaminated area. The high permeability of the site soils mean that if flows into the site are not cut off, significantly greater quantities of water would need to be treated.

Two of these containment structures are projected for the wetlands area: a smaller structure that will surround the area in and around the Western Drainage Gully, and a larger structure encompassing the entire northern wetlands excavation area. By using two separate structures instead of one that surrounds the entire wetlands, substantial material and labor savings will be realized.

Groundwater flow from the sides could instead be cut off by a ring or dewatering wells, but such a system would require constant operation and maintenance throughout the project. A physical wall contains the site passively requiring no maintenance and very little additional pumping.

In addition, a physical wall can be installed in such a way that it supports the excavation with a vertical barrier. Use of a vertical barrier significantly reduces the volume of material which would have to be treated. If the excavation were sloped back on a safe angle of repose, a significantly larger volume of material would have to be treated. The disadvantage of a vertical wall is that it must have sufficient strength to support a ten foot excavation.

Cutting a section where the contamination extends up into the Western Drainage Gully shows that any excavation support must also consider the stability of the hills adjacent to the gully. Since the contamination extends completely across this gully, any confining wall will be located at the toe of the slopes of the hills on the north and south sides. Laying back the slopes in this area would require excavation of significant portions of the adjacent hills.

The base of the containment is required for two reasons. Because of the high permeability of the site soils, it is important to cut off flows from below the project area. It is also necessary to ensure the integrity of the Potomac confining layer. Since the excavation must go down to the top of the Potomac layer, "blowout" of the layer is a strong potential issue when the site is excavated and dewatered.

The base confinement could be formed by dewatering but a constant high volume of inflow would be expected resulting in large pumping costs, maintenance concerns, etc. The contaminated area is large so pumping in the middle of the area would be difficult at best. Therefore, a physical barrier is the preferred solution to seal the bottom of the excavation as

well. A grouted base plug is a reasonable way to form the base seal in granular soils. The base plug must be installed deep enough and thick enough to provide adequate resistance to a blowout of the base and the resulting loss of the confining layer. To satisfy all of these conditions, the base plug is estimated to be five feet thick beneath seven feet of in-situ soil (which will act as ballast).

The physical side walls must tie into the base plug to complete the confinement. A slurry wall was considered but such a wall would not provide the needed structural support, especially in the Western Drainage Gully between the hills. A vertical jet grouted wall is a reasonable solution that meets all the criteria.

It would be possible to extend the jet grout wall to the surface to provide all of the containment. This would limit construction of the confinement features to a single construction technique and material. However, two problems limit this option. First, it would be difficult to provide for the needed structural support with a jet grouted wall. Second, it would be difficult and expensive to demolish the jet grout wall to restore groundwater flows on completion of the project. If it is decided that the jet grout wall on the eastern side of the tributary wetlands will be incorporated into the groundwater containment solution for the interim groundwater remedy, alternatives that might allow the installation of a jet grout wall to the surface in that area will be investigated further.

A sheet pile wall meets all of the criteria for stability and containment of the contaminated area during excavation. Sheet pile can be withdrawn at the end of the project removing the obstacle to natural groundwater flow. Consideration was given to using a sheet pile wall full depth. Use of sheet pile full depth would mean driving it through the Potomac confining layer. This would compromise the integrity of the confining layer both during installation and later when the sheets are withdrawn. Driving the sheets into the jet grouted barrier eliminates both of these concerns.

Preliminary calculations indicate that the sheet pile cannot be cantilevered. This is largely due to the design feature of being able to remove them at the end of the project. The simplest way to provide the sheets with needed support is to tie them back with anchors. It may be possible in final design to eliminate these anchors.

With this system in place, the site can be excavated to a depth of ten feet and the material can be removed for treatment or disposal. The water contained in the contaminated area can also be pumped out (either before or after the excavation) and treated for discharge.

The final feature of this concept is a 48 inch bypass pipe. The contaminated area lies

directly in a natural drainage feature. During the life of the cleanup a considerable volume of runoff water is expected to pass down this drainage. If that water is allowed to flow into the excavation, it will have to be pumped out and treated as contaminated until all contaminated soil is removed. To avoid this, the project envisions a small barrier on the upstream side of the containment area with the 48 inch pipe installed. The pipe would carry runoff around the contaminated area and discharge it directly into Red Lion Creek.

Following construction of the “bath tub,” temporary roadways will be built out onto the wetlands. Extended reach excavators with wide-track tires/treads will be employed to excavate the contaminated materials and load them into dump trucks.

Dewatering

Material excavated from the tributary wetlands and Sedimentation Basin areas will require dewatering prior to treatment in the LTTD unit or transportation off-site. Dewatering prior to LTTD treatment will greatly reduce the energy usage of the treatment system, whereas dewatering of materials prior to transport off-site will reduce the potential for spreading Site-related contaminants beyond the Site boundaries.

Multiple dewatering options were considered. Air drying was ruled out because of the time required to complete the dewatering process and the increased potential for VOC emissions. Filter presses were eliminated because of their poor wear resistance when processing gritty materials like the sandy soils found at the SCD Site. Wear issues are also a concern with a rotary drum thickener. A centrifuge could be used to accomplish this task, but the potential still exists for wear-related damage and their relatively high capital cost is a negative factor. A multi-channel rotary press was selected for use because of its ability to substantially reduce water content of gritty material (such as the sandy soils encountered here) without suffering extensive wear or damage.

Water from dewatering of excavated materials will be treated and discharged using the approach described above for groundwater and runoff resulting from excavation activities. As a result, one discharge – and therefore one NPDES permit – will be used for both water streams.

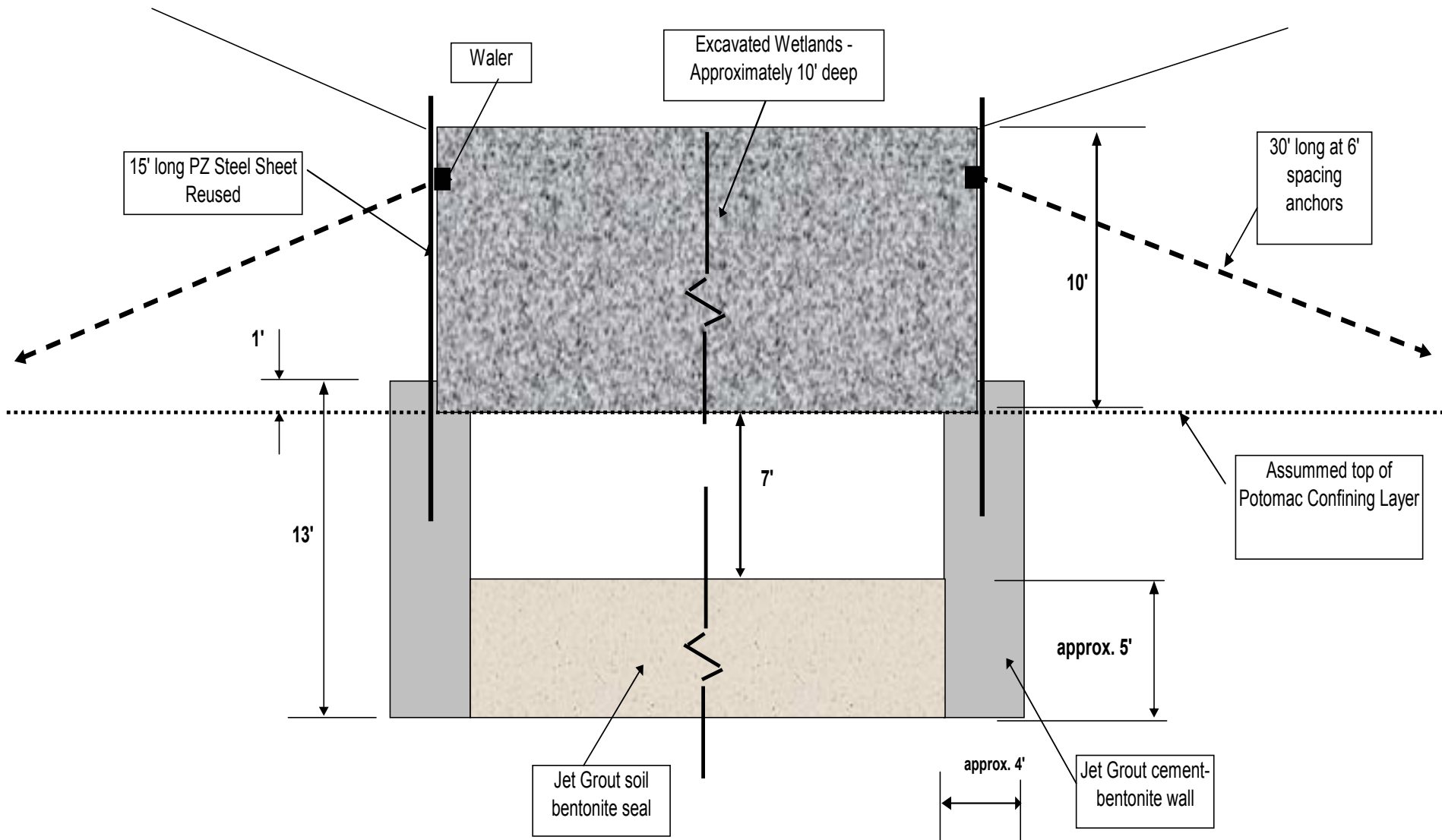


Figure A-1

Wetlands Excavation Support Structure (Cross-Section)

**Standard Chlorine of Delaware
Delaware City, Delaware**



BLACK & VEATCH

EPA Contract No.: 68-S7-3002
Work Assignment No.:038-RDRD-03H6
Black & Veatch Project No. 47118.128

Design Comparison Study
Revision: 0
June 13, 2003

APPENDIX B

M-CACES Cost Estimate

EPA Contract No.: 68-S7-3002
Work Assignment No.:038-RDRD-03H6
Black & Veatch Project No. 47118.128

Design Comparison Study
Revision: 0
June 13, 2003

Onsite Treatment Alternative

Wed 04 Jun 2003
Eff. Date 06/01/03

Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by On

TIME 10:34:31

TITLE PAGE 1

SCD Wetlands Remediation
Excavate and Treat Soils by On
Site Low Temperature Thermal
Desorbition

Designed By: BVSPC - Conceptual Stage
Estimated By: M. Ledbetter

Prepared By: M. Ledbetter

Preparation Date: 06/01/03
Effective Date of Pricing: 06/01/03

Sales Tax: 0.00%

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LABOR ID: CHIILL

EQUIP ID: NAT97C

Currency in DOLLARS

CREW ID: NAT99A UPB ID: UP99EA

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Eff. Date 06/01/03

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TIME 10:34:31

SUMMARY PAGE 1

** PROJECT OWNER SUMMARY - ACCOUNT **

		QUANTY UOM	CONTRACT	DES CONT	ESCALATN	CON CONT	OTHER	CON MGMT	TOTAL COST	UNIT COST
33	HTRW Remedial Action	132000 CY	47,097,765	0	0	9,419,553	0	0	56,517,318	428.16
	SCD Wetlands Remediation		47,097,765	0	0	9,419,553	0	0	56,517,318	

Wed 04 Jun 2003
Eff. Date 06/01/03

Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by On

TIME 10:34:31

SUMMARY PAGE 2

** PROJECT OWNER SUMMARY - SYSTEM **

		QUANTY UOM	CONTRACT	DES CONT	ESCALATN	CON CONT	OTHER	CON MGMT	TOTAL COST	UNIT COST
33 HTRW Remedial Action										
33.01	Mobilize and Prepara	1.00 EA	367,586	0	0	73,517	0	0	441,103	441103.32
33.02	Monitoring, Sampling	1.00 EA	35,048	0	0	7,010	0	0	42,058	42058.14
33.03	Site Work	1.00 EA	9,655,729	0	0	1,931,146	0	0	11,586,874	11586874.42
33.05	Surface Water Collec	1.00 EA	117,468	0	0	23,494	0	0	140,962	140961.73
33.06	Groundwater Collect	1.00 EA	603,252	0	0	120,650	0	0	723,903	723902.67
33.09	Liq/Sed/Sludges Coll	130000 CY	2,573,694	0	0	514,739	0	0	3,088,432	23.76
33.12	Chemical Treatment	1.00 EA	130,050	0	0	26,010	0	0	156,060	156059.90
33.14	Thermal Treatment	130000 CY	32,578,480	0	0	6,515,696	0	0	39,094,176	300.72
33.20	Site Restoration	1.00 EA	776,357	0	0	155,271	0	0	931,629	931628.94
33.21	Demobilization	1.00 EA	260,100	0	0	52,020	0	0	312,120	312119.81
TOTAL HTRW Remedial Action			132000 CY 47,097,765	0	0	9,419,553	0	0	56,517,318	428.16
TOTAL SCD Wetlands Remedia			47,097,765	0	0	9,419,553	0	0	56,517,318	

Wed 04 Jun 2003
Eff. Date 06/01/03

Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by On

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SUMMARY PAGE 3

** PROJECT INDIRECT SUMMARY - ACCOUNT **

	QUANTY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
33 HTRW Remedial Action	132000 CY	36,215,143	4,345,817	1,622,438	4,218,340	696,026	47,097,765	356.80
SCD Wetlands Remediation		36,215,143	4,345,817	1,622,438	4,218,340	696,026	47,097,765	
Construction Contingencies							9,419,553	
TOTAL INCL OWNER COSTS							56,517,318	

Wed 04 Jun 2003
Eff. Date 06/01/03

Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by On

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SUMMARY PAGE 4

** PROJECT INDIRECT SUMMARY - SYSTEM **

			QUANTITY	UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
33 HTRW Remedial Action											
33.01	Mobilize and Preparatory Work	1.00	EA		282,650	33,918	12,663	32,923	5,432	367,586	367586.10
33.02	Monitoring, Sampling, & Testin	1.00	EA		26,950	3,234	1,207	3,139	518	35,048	35048.45
33.03	Site Work	1.00	EA		7,424,633	890,956	332,624	864,821	142,695	9,655,729	9655728.68
33.05	Surface Water Collect & Contro	1.00	EA		90,325	10,839	4,047	10,521	1,736	117,468	117468.11
33.06	Groundwater Collect & Control	1.00	EA		463,862	55,663	20,781	54,031	8,915	603,252	603252.22
33.09	Liq/Sed/Sludges Collect-Contai	130000	CY		1,979,004	237,481	88,659	230,514	38,035	2,573,694	19.80
33.12	Chemical Treatment	1.00	EA		100,000	12,000	4,480	11,648	1,922	130,050	130049.92
33.14	Thermal Treatment	130000	CY		25,050,750	3,006,090	1,122,274	2,917,911	481,455	32,578,480	250.60
33.20	Site Restoration	1.00	EA		596,969	71,636	26,744	69,535	11,473	776,357	776357.45
33.21	Demobilization	1.00	EA		200,000	24,000	8,960	23,296	3,844	260,100	260099.84
TOTAL HTRW Remedial Action			132000	CY	36,215,143	4,345,817	1,622,438	4,218,340	696,026	47,097,765	356.80
TOTAL SCD Wetlands Remediation					36,215,143	4,345,817	1,622,438	4,218,340	696,026	47,097,765	
Construction Contingencies										9,419,553	
TOTAL INCL OWNER COSTS										56,517,318	

Wed 04 Jun 2003
Eff. Date 06/01/03

Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by On

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SUMMARY PAGE 5

** PROJECT DIRECT SUMMARY - ACCOUNT **

	QUANTITY	UOM	MANHOUR	LABOR	EQUIPMNT	MATERIAL	SUBCONTR	TOTAL COST	UNIT COST
33 HTRW Remedial Action	132000	CY	34,167	1,740,783	1,957,485	239,351	32277525	36,215,143	274.36
TOTAL SCD Wetlands Remediation			34,167	1,740,783	1,957,485	239,351	32277525	36,215,143	
Field Overhead								4,345,817	
SUBTOTAL								40,560,960	
Home Ofc. Overhead								1,622,438	
SUBTOTAL								42,183,399	
Profit								4,218,340	
SUBTOTAL								46,401,739	
Bond								696,026	
TOTAL INCL INDIRECTS								47,097,765	
Construction Contingencies								9,419,553	
TOTAL INCL OWNER COSTS								56,517,318	

Wed 04 Jun 2003
Eff. Date 06/01/03

Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by On

TIME 10:34:31

SUMMARY PAGE 6

** PROJECT DIRECT SUMMARY - SYSTEM **

	QUANTY	UOM	MANHOUR	LABOR	EQUIPMNT	MATERIAL	SUBCONTR	TOTAL COST	UNIT COST
33 HTRW Remedial Action									
33.01 Mobilize and Preparatory Work	1.00	EA	0	0	0	0	282,650	282,650	282650.00
33.02 Monitoring, Sampling, & Testing	1.00	EA	0	12,250	0	4,200	10,500	26,950	26950.00
33.03 Site Work	1.00	EA	10,027	481,153	169,183	198,171	6,576,125	7,424,633	7424632.54
33.05 Surface Water Collect & Control	1.00	EA	1,000	42,139	11,206	36,980	0	90,325	90325.40
33.06 Groundwater Collect & Control	1.00	EA	4,000	286,627	39,735	0	137,500	463,862	463862.05
33.09 Liq/Sed/Sludges Collect-Contain	130000	CY	13,530	632,333	1,346,672	0	0	1,979,004	15.22
33.12 Chemical Treatment	1.00	EA	0	0	0	0	100,000	100,000	100000.00
33.14 Thermal Treatment	130000	CY	0	0	0	0	25050750	25,050,750	192.70
33.20 Site Restoration	1.00	EA	5,610	236,280	240,689	0	120,000	596,969	596968.80
33.21 Demobilization	1.00	EA	0	50,000	150,000	0	0	200,000	200000.00
TOTAL HTRW Remedial Action	132000	CY	34,167	1,740,783	1,957,485	239,351	32277525	36,215,143	274.36
TOTAL SCD Wetlands Remediation			34,167	1,740,783	1,957,485	239,351	32277525	36,215,143	
Field Overhead								4,345,817	
SUBTOTAL								40,560,960	
Home Ofc. Overhead								1,622,438	
SUBTOTAL								42,183,399	
Profit								4,218,340	
SUBTOTAL								46,401,739	
Bond								696,026	
TOTAL INCL INDIRECTS								47,097,765	
Construction Contingencies								9,419,553	
TOTAL INCL OWNER COSTS								56,517,318	

EPA Contract No.: 68-S7-3002
Work Assignment No.:038-RDRD-03H6
Black & Veatch Project No. 47118.128

Design Comparison Study
Revision: 0
June 13, 2003

Off-Site Treatment Alternative

Thu 05 Jun 2003
Eff. Date 06/01/03

Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by Off

TIME 09:04:48
TITLE PAGE 1

SCD Wetlands Remediation
Excavate and Treat Soils by Off
Site Low Temperature Thermal
Desorbition

Designed By: BVSPC - Conceptual Stage
Estimated By: M. Ledbetter

Prepared By: M. Ledbetter

Preparation Date: 06/01/03
Effective Date of Pricing: 06/01/03

Sales Tax: 0.00%

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Thu 05 Jun 2003
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Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by Off

TIME 09:04:48

SUMMARY PAGE 1

** PROJECT OWNER SUMMARY - ACCOUNT **

		QUANTY UOM	CONTRACT	DES CONT	ESCALATN	CON CONT	OTHER	CON MGMT	TOTAL COST	UNIT COST
33	HTRW Remedial Action	132000 CY	104,467,011	0	0	20893402	0	0	125,360,413	949.70
	SCD Wetlands Remediation		104,467,011	0	0	20893402	0	0	125,360,413	

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Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by Off

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SUMMARY PAGE 2

** PROJECT OWNER SUMMARY - SYSTEM **

	QUANTITY UOM	CONTRACT	DES CONT	ESCALATN	CON CONT	OTHER	CON MGMT	TOTAL COST	UNIT COST
33 HTRW Remedial Action									
33.01 Mobilize and Prepara	1.00 EA	324,670	0	0	64,934	0	0	389,604	389603.55
33.02 Monitoring, Sampling	1.00 EA	35,048	0	0	7,010	0	0	42,058	42058.14
33.03 Site Work	1.00 EA	9,655,729	0	0	1,931,146	0	0	11,586,874	11586874.42
33.05 Surface Water Collec	1.00 EA	117,468	0	0	23,494	0	0	140,962	140961.73
33.06 Groundwater Collect	1.00 EA	603,252	0	0	120,650	0	0	723,903	723902.67
33.09 Liq/Sed/Sludges Coll	130000 CY	2,573,694	0	0	514,739	0	0	3,088,432	23.76
33.12 Chemical Treatment	1.00 EA	130,050	0	0	26,010	0	0	156,060	156059.90
33.14 Thermal Treatment	130000 CY	89,223,349	0	0	17844670	0	0	107,068,018	823.60
33.20 Site Restoration	1.00 EA	1,634,687	0	0	326,937	0	0	1,961,624	1961624.30
33.21 Demobilization	1.00 EA	169,065	0	0	33,813	0	0	202,878	202877.88
TOTAL HTRW Remedial Action	132000 CY	104,467,011	0	0	20893402	0	0	125,360,413	949.70
TOTAL SCD Wetlands Remedia		104,467,011	0	0	20893402	0	0	125,360,413	

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Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by Off

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SUMMARY PAGE 3

** PROJECT INDIRECT SUMMARY - ACCOUNT **

	QUANTY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
33 HTRW Remedial Action	132000 CY	80,328,393	9,639,407	3,598,712	9,356,651	1,543,847	104,467,011	791.42
SCD Wetlands Remediation		80,328,393	9,639,407	3,598,712	9,356,651	1,543,847	104,467,011	
Construction Contingencies							20,893,402	
TOTAL INCL OWNER COSTS							125,360,413	

Thu 05 Jun 2003
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Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by Off

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SUMMARY PAGE 4

** PROJECT INDIRECT SUMMARY - SYSTEM **

	QUANTY UOM	DIRECT	FIELD OH	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
33 HTRW Remedial Action								
33.01 Mobilize and Preparatory Work.	1.00 EA	249,650	29,958	11,184	29,079	4,798	324,670	324669.63
33.02 Monitoring, Sampling, & Testin	1.00 EA	26,950	3,234	1,207	3,139	518	35,048	35048.45
33.03 Site Work	1.00 EA	7,424,633	890,956	332,624	864,821	142,695	9,655,729	9655728.68
33.05 Surface Water Collect & Contro	1.00 EA	90,325	10,839	4,047	10,521	1,736	117,468	117468.11
33.06 Groundwater Collect & Control	1.00 EA	463,862	55,663	20,781	54,031	8,915	603,252	603252.22
33.09 Liq/Sed/Sludges Collect-Contai	130000 CY	1,979,004	237,481	88,659	230,514	38,035	2,573,694	19.80
33.12 Chemical Treatment	1.00 EA	100,000	12,000	4,480	11,648	1,922	130,050	130049.92
33.14 Thermal Treatment	130000 CY	68,607,000	8,232,840	3,073,594	7,991,343	1,318,572	89,223,349	686.33
33.20 Site Restoration	1.00 EA	1,256,969	150,836	56,312	146,412	24,158	1,634,687	1634686.92
33.21 Demobilization	1.00 EA	130,000	15,600	5,824	15,142	2,498	169,065	169064.90
TOTAL HTRW Remedial Action	132000 CY	80,328,393	9,639,407	3,598,712	9,356,651	1,543,847	104,467,011	791.42
TOTAL SCD Wetlands Remediation		80,328,393	9,639,407	3,598,712	9,356,651	1,543,847	104,467,011	
Construction Contingencies							20,893,402	
TOTAL INCL OWNER COSTS							125,360,413	

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Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by Off

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SUMMARY PAGE 5

** PROJECT DIRECT SUMMARY - ACCOUNT **

	QUANTY	UOM	MANHOUR	LABOR	EQUIPMNT	MATERIAL	SUBCONTR	TOTAL COST	UNIT COST
33 HTRW Remedial Action	132000	CY	34,167	1,730,783	1,897,485	899,351	75800775	80,328,393	608.55
TOTAL SCD Wetlands Remediation			34,167	1,730,783	1,897,485	899,351	75800775	80,328,393	
Field Overhead								9,639,407	
SUBTOTAL								89,967,800	
Home Ofc. Overhead								3,598,712	
SUBTOTAL								93,566,512	
Profit								9,356,651	
SUBTOTAL								102,923,164	
Bond								1,543,847	
TOTAL INCL INDIRECTS								104,467,011	
Construction Contingencies								20,893,402	
TOTAL INCL OWNER COSTS								125,360,413	

Thu 05 Jun 2003
Eff. Date 06/01/03

Tri-Service Automated Cost Engineering System (TRACES)
PROJECT SCDWET: SCD Wetlands Remediation - Excavate and Treat Soils by Off

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SUMMARY PAGE 6

** PROJECT DIRECT SUMMARY - SYSTEM **

	QUANTITY	UOM	MANHOUR	LABOR	EQUIPMNT	MATERIAL	SUBCONTR	TOTAL COST	UNIT COST
33 HTRW Remedial Action									
33.01 Mobilize and Preparatory Work	1.00	EA	0	0	0	0	249,650	249,650	249650.00
33.02 Monitoring, Sampling, & Testing	1.00	EA	0	12,250	0	4,200	10,500	26,950	26950.00
33.03 Site Work	1.00	EA	10,027	481,153	169,183	198,171	6,576,125	7,424,633	7424632.54
33.05 Surface Water Collect & Control	1.00	EA	1,000	42,139	11,206	36,980	0	90,325	90325.40
33.06 Groundwater Collect & Control	1.00	EA	4,000	286,627	39,735	0	137,500	463,862	463862.05
33.09 Liq/Sed/Sludges Collect-Contain	130000	CY	13,530	632,333	1,346,672	0	0	1,979,004	15.22
33.12 Chemical Treatment	1.00	EA	0	0	0	0	100,000	100,000	100000.00
33.14 Thermal Treatment	130000	CY	0	0	0	0	68607000	68,607,000	527.75
33.20 Site Restoration	1.00	EA	5,610	236,280	240,689	660,000	120,000	1,256,969	1256968.80
33.21 Demobilization	1.00	EA	0	40,000	90,000	0	0	130,000	130000.00
TOTAL HTRW Remedial Action	132000	CY	34,167	1,730,783	1,897,485	899,351	75800775	80,328,393	608.55
TOTAL SCD Wetlands Remediation			34,167	1,730,783	1,897,485	899,351	75800775	80,328,393	
Field Overhead								9,639,407	
SUBTOTAL								89,967,800	
Home Ofc. Overhead								3,598,712	
SUBTOTAL								93,566,512	
Profit								9,356,651	
SUBTOTAL								102,923,164	
Bond								1,543,847	
TOTAL INCL INDIRECTS								104,467,011	
Construction Contingencies								20,893,402	
TOTAL INCL OWNER COSTS								125,360,413	

EPA Contract No.: 68-S7-3002
Work Assignment No.:038-RDRD-03H6
Black & Veatch Project No. 47118.128

Design Comparison Study
Revision: 0
June 13, 2003

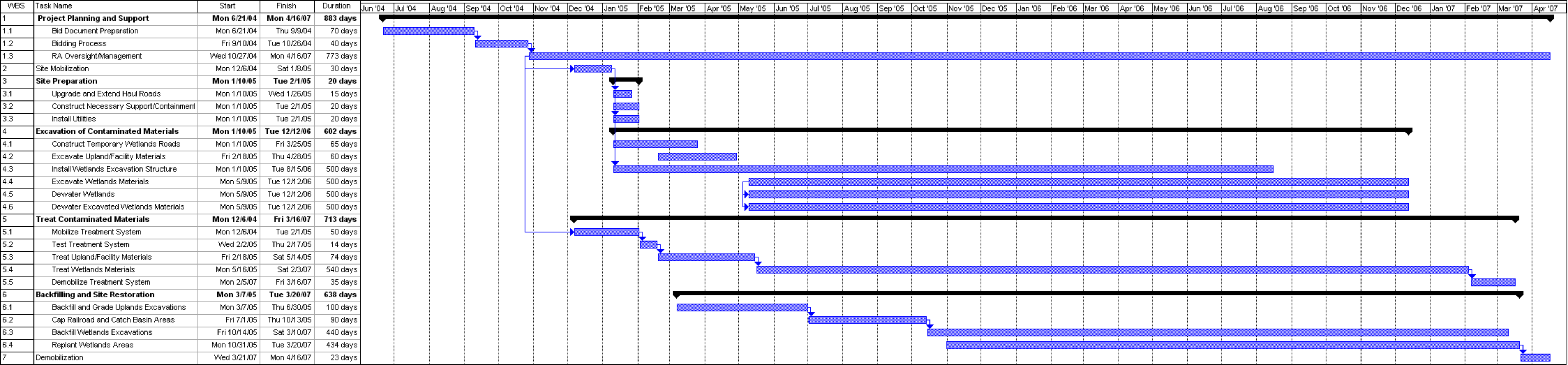
APPENDIX C

RA Construction Schedule

EPA Contract No.: 68-S7-3002
Work Assignment No.:038-RDRD-03H6
Black & Veatch Project No. 47118.128

Design Comparison Study
Revision: 0
June 13, 2003

Onsite Treatment Alternative



EPA Contract No.: 68-S7-3002
Work Assignment No.:038-RDRD-03H6
Black & Veatch Project No. 47118.128

Design Comparison Study
Revision: 0
June 13, 2003

Off-Site Treatment Alternative

